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Design and simulation of Film Bulk Acoustic Wave Resonator (FBAR) Gas Sensor Based on ZnO Thin Film (Conference Paper)

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Abstract

The interest in miniature device has led to the development of thin film bulk acoustic wave resonator (FBAR). The function of a resonator to gain a high resonant frequency value of an equipment make FBAR is suitable to act as sensor and filter for wide range of applications. The success of FBAR in providing a reduction of cost and power consumption make it an applicable device. It can be integrated with carbon nanotubes and oscillator circuit to enhance its performance as a gas sensor. Some of the chosen piezoelectric thin film are zinc oxide (ZnO) and aluminum nitride (AlN). This paper focuses on implementing FBAR as gas sensing application to monitor a person's health using breath analysis. The establishment of FBAR sensor to detect acetone gas as breath marker for diabetic disease through breath analysis is emphasize in this paper. A thin film FBAR is modelled using finite element simulation to evaluate its performances in term of coupling coefficient, sensitivity and resonance frequency. Zinc oxide was chosen as the piezoelectric thin film, aluminum as electrodes and silicon as substrate. FBAR sensor with ZnO thickness of 4.4\ \boldsymbol{\mu} \mathbf{m} demonstrated the highest coupling coefficient of 0.0643 at 472.65 MHz resonance frequency. The result is comparable to other previous works on FBAR sensor. Hence, this work indicates that FBAR has high potential for breath analysis. It can detect which type of gases exhaled by patient based on the different mass sensitivity value and different type of diseases can be identified. © 2019 IEEE.

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