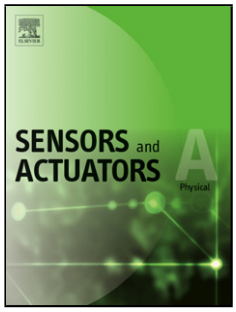

Title: Investigation of Sacrificial Layer Masking Fabrication of Dual-Frequency Quartz Crystal Microbalance

Authors: Zhangliang Xu, Zhengqi He, Yong J. Yuan

PII: S0924-4247(18)30670-8
DOI: https://doi.org/10.1016/j.sna.2018.09.026
Reference: SNA 11001

To appear in: *Sensors and Actuators A*

Received date: 8-5-2018
Revised date: 1-8-2018
Accepted date: 10-9-2018

Please cite this article as: Xu Z, He Z, Yuan YJ, Investigation of Sacrificial Layer Masking Fabrication of Dual-Frequency Quartz Crystal Microbalance, *Sensors and amp; Actuators: A. Physical* (2018), https://doi.org/10.1016/j.sna.2018.09.026

Investigation of Sacrificial Layer Masking Fabrication of Dual-Frequency Quartz Crystal Microbalance

Zhangliang Xu, Zhengqi He, Yong J. Yuan*

Laboratory of Biosensing and MicroMechatronics, School of Materials Science and Engineering, Southwest Jiaotong University, Chengdu 610031, China
*Corresponding author: yongyuan@swjtu.edu.cn

Highlights for review

- dual-channel/frequency QCM-on-a-chip
- tunable frequencies on one-chip monolithic device
- precise micro-nano scale structure fabrications

Abstract: To solve temperature compensation problems and eliminate environmental impact factors for quartz crystal resonators, a study on one-chip inverted mesa multi-channel/frequency quartz crystal microbalance (MQCM) was presented. MQCM was fabricated by a simple, precision controlled and plasma-ion-beam etching technique. The research intention was devoted to etching nanometer-scale depth inverted mesa of a quartz wafer using aluminum (Al) as a sacrificial layer. The masking method was demonstrated with 0.497 mA/cm^2 ion-beam density, 300 eV argon-ion energy and 1.0 μm/h etching rate. Both morphology of etched surface and its depth were characterized by laser scanning confocal microscope (LSCM). Resonant frequencies of a fabricated MQCM indicated that the thinning approach demonstrated will fine tune relevant QCM resonant frequency as proposed. The one-chip dual-QCM in the case of 3.28 μm depth etching would result in its fundamental resonance peak shifted at 0.5054 MHz. The inverted mesa etched at micron level significantly will provide fine-tunable frequencies on one-chip monolithic device fabricated. The simple adhesion-type Al sacrificial layer masking method and plasma etching technique do have great potential for precise micro-nano scale structure fabrications.