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Non-Confidential Description - PSU No. 3666
"Ultra-Sensitive Temperature Detection Using Resonant Devices"

Keywords:

microscale arrays, crystal resonators, temperature detection

Links:

http://mnd.ee.psu.edu/index.asp

Inventors:

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Background

Certain crystal cuts can provide high temperature dependency on the resonant frequency. Some crystal cuts, like the Y-cut quartz, provide variations in the resonant frequency in the order of 90 ppm/K. However, a primary limitation of using crystal resonators as sensitive temperature sensors in biomedical applications arises from the fact that direct placement of analyte on resonator surfaces confound temperature related frequency shift with simultaneous mass loading effects.

Invention Description

This new method uses micromachining techniques to fabricate an extremely small thermal mass – reaction chamber array in close proximity (100 nm – 1 mm) range to a quartz resonator array. This allows for direct detection of temperature changes of the reaction chamber in response to the biochemical reactions while the separation allows for decoupling of the mass loading effect.
The new method can be used on applications where extremely high temperature sensitivity is desired, particularly for infra-red image and biomedical sensing applications where the monitoring process consists of detection of small temperature changes.

Applications

- biochemical detection and biological applications, such as cell culturing and monitoring and clinical diagnostic applications
- chemical sensing for homeland security and general scientific applications
- any calorimetric measurement whereby the coupling of the heat is through radiative transfer of energy.
- any temperature based sensing application where highly sensitive detection is desired
- US utility application filed, publication # 20110228809

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