Tohoku Univ. Technology

Temperature sensing and vibration detection method

Wiring-free miniature temperature sensor

Overview

Conventional thermal property measurements using thermistors and thermocouples require electrical wiring, **which limits further improvements in sensor density and sensitivity**. Resonant temperature sensors using in-plane mechanical resonators also suffer from **low areal density**, and laser-based readout becomes **impractical when many sensing points** are required.

To overcome these limitations, the inventors developed a **wiring-free temperature sensor** that optically detects the resonance vibration amplitude of a high–aspect ratio micro-resonator. This architecture is well suited to **dense array integration and achieves a temperature sensitivity of 32%/°C, exceeding that of frequency-shift-based resonant sensors (35 ppm/°C) and thermistors (2.0%/°C),** making it promising for high-sensitivity temperature measurement.

Product Application

- ☐ Thermal property measurement and analysis apparatus
- ☐ Temperature distribution measurement of small areas

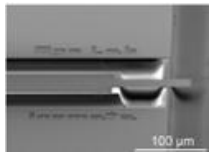
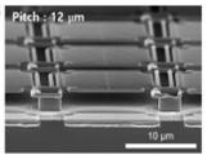
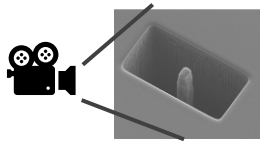
IP Data

IP No. : Not published
Inventors : INOMATA Naoki
Admin No.: T25-060

Features・Outstandings

Overview

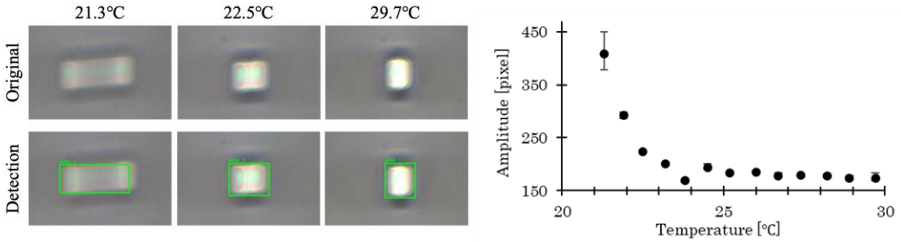
・Comparison table with existing technologies

	Mechanical resonance*1	Thermistor*2	Invention (Micro pillar×imaging)
			
Feature	・Planar layout ・Laser-based Integration… ・Increase in size ・Requires many laser	・Detection of capacitance ・Unfavorable for integration ・Require cooling	・**Wireing-free** ・**Array integration** ↓ **High integration and resolution expected.**

*1. https://doi.org/10.1039/C6LC00949B *2. https://doi.org/10.3390/s21206722

Embodiments of the Invention

The pillar was driven at 676 kHz (21.3 °C), and images were taken while heating from 23 to 45 °C in ~2 °C steps.



High-sensitivity temperature measurement from vibration amplitude (**32%/°C**)

Contact

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