Durham University

MEMS Multimorph Capacitive Temperature Sensors in COMSOL Multiphysics®

Level 3 Semiconductor, Physics and Devices

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Abstract

This report describes how the C–T characteristics of MEMS multimorph capacitive temperature sensors vary with geometry, material choice and thermal-annealing temperature. The sensors were modelled using FEM and physics simulation software—COMSOL Multiphysics®—so the key design choices for the model and mesh are also included.

Nomenclature

MEMS Microelectromechanical systems

1 Introduction

In an increasingly data centric world with the number of sensors

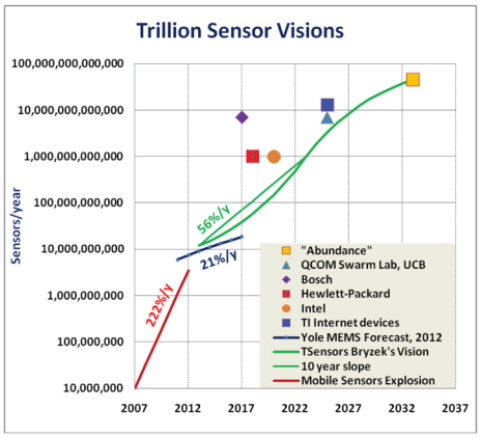

Figure 1: Janusz Bryzek's trillion sensor vision.

why sense temperature?
what temperature sensors are available?
why MEMS*?*

2 Background

what is a multimorph capacitor?

2.1 Construction

how do we build an effective multimorph
how do we make the sensor practical

2.2 Characterisation

multimorph capacitance
how do we characterise sensitivity?
how do we characterise linearity?

3 Modelling

3.1 Geometry

symmetry

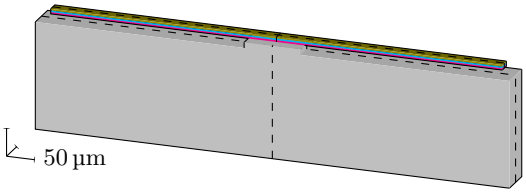

Figure 2: Symmetry lines of the multimorph capacitive temperature sensor—marked with dashed lines.

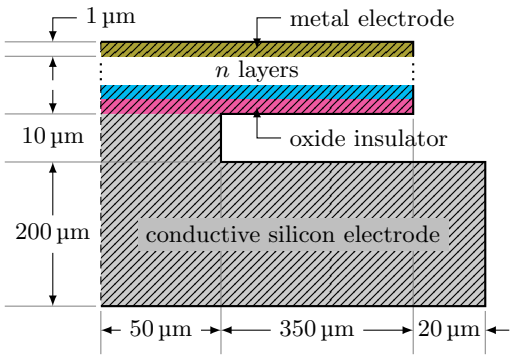

Figure 3: Cross-section of the multimorph temperature sensor—not to scale.

dimensions
mesh

3.2 Materials

3.3 Physics

4 Results

5 Analysis

6 Conclusion