

Brought to you by [INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA](#)

Scopus

[Back](#)

# Comparative analysis of MEMS pressure sensor using graphene and carbon nanotube as piezoresistive material

[Microsystem Technologies](#) • Article • 2026 • DOI: 10.1007/s00542-026-06073-6

[Salimun, Nor Liana](#); [Ralib, Aliza Aini Md](#) ; [Rahim, Rosminazuin Ab](#)

VLSI-MEMS Research Unit, Department of Electrical and Computer Engineering, Kulliyah of Engineering, International Islamic University Malaysia, Kuala Lumpur, Malaysia

[Show all information](#)

0

Citations

[View PDF](#)[Full text](#) [Export](#) [Save to list](#) [Document](#)[Impact](#)[Cited by \(0\)](#)[References \(24\)](#)[Similar documents](#)

## Abstract

Pressure sensors are essential to ensure the efficiency of the health monitoring system such as rehabilitation and ergonomic application. Compared to traditional health monitoring, miniature size for low power consumption, flexibility, biocompatibility, rapidity, and low-cost sensors are among the essential parameters. Micro-Electro-Mechanical System (MEMS) pressure sensors offer very small size where it can respond rapidly to a very small changes in pressure with high sensitivity and excellent linearity. Selection of piezoresistive material is crucial to enhance the performance of MEMS pressure sensor. Silicon-based MEMS piezoresistive pressure sensor suffers from brittleness and poor scalability. As such, carbon nanomaterial such carbon nanotube and graphene offer promising solutions as piezoresistive materials. To the best of our knowledge, there has been limited findings on the analysis of different type of carbon-based piezoresistive pressure (Graphene and CNT) sensors in terms of change of resistance, linearity and sensitivity through finite element

simulation. Hence, the aim of this paper is to compare and analyze two different carbon nano materials (graphene and carbon nanotube) that act as piezoresistive materials for MEMS pressure sensor with combinational Dash & E-shape design. Finite element simulation results show that graphene-based MEMS piezoresistive pressure sensor shows high sensitivity of 0.6458 mV/V·mmHg. As on linearly increasing the output voltage, it is noticed that graphene performs well with 99% linearity compared to CNT by applying only 1 V biased voltage. Hence, this analysis opens the path to show that carbon-based MEMS piezoresistive pressure sensor based on carbon nanomaterial has potential to be implemented for various potential applications, including human-interactive electronics. © The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2026.

## Author keywords

Carbon nanotube; Graphene; Linearity; MEMS pressure sensor; Piezoresistive material; Sensitivity

## Indexed keywords

### Engineering controlled terms

Ergonomics; MEMS; Nanocomposites; Yarn

### Engineering uncontrolled terms

Carbon nano-materials; Graphenes; High sensitivity; Linearity; MEMS (microelectromechanical system); Micro-electro-mechanical system pressure sensor; Piezoresistive materials; Piezoresistive pressure sensors; Sensitivity; System Pressure sensors

### Engineering main heading

Carbon nanotubes; Graphene; Pressure sensors

## Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

Funding sponsor	Funding number	Acronym
Ministry of Higher Education	<a href="#">See opportunities by MOHE ↗</a>	MOHE

Funding sponsor	Funding number	Acronym
Fundamental Research Grant Scheme	FRGS 21-249-0858, FRGS/1/2021/TK0/UIAM/02/14	

### Funding text

This work is fully supported by the Ministry of Higher Education (MOHE) Fundamental Research Grant Scheme (FRGS 21-249-0858) (Grant No: FRGS/1/2021/TK0/UIAM/02/14).

## Corresponding authors

Corresponding author A.A.M. Ralib

Affiliation VLSI-MEMS Research Unit, Department of Electrical and Computer Engineering, Kulliyah of Engineering, International Islamic University Malaysia, Kuala Lumpur, Malaysia

Email address alizaaini@iium.edu.my

© Copyright 2026 Elsevier B.V., All rights reserved.

### Abstract

Author keywords

Indexed keywords

Funding details

Corresponding authors

## About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)