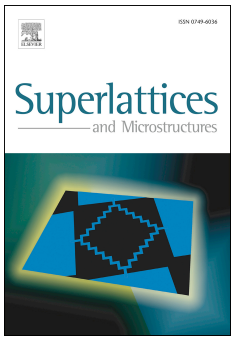
Accepted Manuscript



Pressure sensor based on MEMS nano-cantilever beam structure as a heterodielectric gate electrode of dopingless TFET

Gagan Kumar, Ashish Raman

PII: S0749-6036(16)30514-6

DOI: 10.1016/j.spmi.2016.10.010

Reference: YSPMI 4555

To appear in: *Superlattices and Microstructures*

Received Date: 19 July 2016

Accepted Date: 3 October 2016

Please cite this article as: G. Kumar, A. Raman, Pressure sensor based on MEMS nano-cantilever beam structure as a heterodielectric gate electrode of dopingless TFET, *Superlattices and Microstructures* (2016), doi: 10.1016/j.spmi.2016.10.010.

Pressure Sensor Based on MEMS Nano-Cantilever Beam Structure as a Heterodielectric Gate Electrode of Dopingless TFET

Gagan Kumar, Ashish Raman
VLSI Design Department of ECE, NIT Jalandhar (Punjab)-144011

Abstract- Micro-electromechanical systems (MEMS) technology has enticed numerous scientists since recent decades particularly in the field of miniaturized-sensors and actuators. Pressure sensor is pivotal component in both of the forerunning fields. The pursuance of a pressure sensor is exigently relying upon its different physical properties i.e. Piezo-resistive, Piezoelectric, Capacitive, Magnetic and Electrostatic. This article presents an outline and scrutiny of the Doping-less Cantilever Based Pressure Sensor using tunnel field effect transistor technology. The propounded pressure sensor based on the principle of capacitive gate coupling, due to which the tunneling current is modified. Additionally, to enhance the affectability of pressure sensor, the work function of metal gate electrode is amended using gas molecule diffusion. Simulation uncovers a phenomenal relationship amongst hypothetical and practical accepts of configuration. The pressure sensor is composed at Silvaco Atlas tool utilizing 40 nm technologies. The performance results exhibit that the proposed model consumes $\leq$ 1 mW power and 250 µA tunneling current per nm bending of cantilever beam structure. The inclusive length of the proposed device is 100 nm.

Keywords— Doping Less Tunnel Field Effect Transistor (DTFET); Pressure Sensor; Micro-Electromechanical System (MEMS).

I. INTRODUCTION

MEMS device has turned into a trademark innovation for the modern era. Its efficiency to sense, analyses, computes and control all inside a solitary chip, gives numerous new and effective artifacts. MEMS device is an emanating device in many domains of science and technology such as engineering, electronics and life sciences [1]. The principle key element for MEMS based device is mechanical structure that can be allied to motion and electrical signal. The change in the parameter of the mechanical structure with an electronic chip gives an incredible enhancement to the performance and processing. These devices have overwhelmingly utilized as a part of the present business sector for automobiles and computer storage system and [2]. Smart vehicles are hinged on the broad utilization of sensors and actuators. Numerous type of sensors is designed to decide the environment or road conditions and the actuators are practiced to effectuate any action, requisites to tackle with circumstances appeared for example Global Positioning System (GPS) and accelerometer for airbag system [1,2].

2. EARLIER WORK

A micro gas-flow sensor consisting of a heat sink and a flow guide on the underneath of the sensing element is conferred in [6], and demonstrated that the device had a power consumption of 8 mW and was equipped for measuring flow velocities up to a level of 5 ms^{-1}.In [7], a single-wire-type thermal flow sensor comprising of a polysilicon micro-heater is contrived, and uncovered that the device had a wide estimation scope of 0.005-35 ms^{-1} a quick response time of just 0.14ms (90%), and a power dissipation of 6 mW. It has been analyzed that the Cantilever based sensors are the most straightforward devices amongst MEMS devices that offer an exceptionally propitious future for the advancement of novel physical, chemical and organic sensors [2]. It is additionally ended up being exceptionally flexible devices and utilized as a part of various fields such as chemical sensors, accelerometer etc [8]. A piezo-resistive based flow sensor with a silicon cantilever probe is designed in [11], in which the gas flow was