International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Special Issue: 09 | Sep -2017 www.irjet.net p-ISSN: 2395-0072

One Day International Seminar on Materials Science & Technology (ISMST 2017)
4th August 2017
Organized by
Department of Physics, Mother Teresa Women's University, Kodaikanal, Tamilnadu, India

Characterization of Polyvinylpyrrolidone material coated Piezoresistive MEMS/ NEMS cantilever analysis and experimentation using OmniCant for high Sensitivity and selectivity

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Abstract - *Sensing and detection of Nano cantilevers are working a very important role functions in the modern day world, especially in the medicine, chemistry, environmental monitoring applications, biomedical & in Nano electronics engineering. Detection and sensing is being presented in Nano cantilever by fabricating it adaptable. In recent years, sensing and detection of Nano cantilever characteristics using Nano materials, analytes has experienced care taken and has become an important problem in the design and fabrication of Nano cantilevers. One of the ways to tackle this sensing and detection problem is to design and fabricate smart, intelligent, and adaptive by working properly by use of Nano smart materials, analytes; else they may affect its resonance frequency, change in resistance with time, sensitivity, and its good functioning is demonstrated. These smart materials and analytes can be used to get good sensing and detection response in the Nano electro mechanical system which has the possible to reduce the detection and sensing problem of the MEMS/NEMS system caused by the elementary material layer and analytes of sensing layer. In the present paper, we investigated a new, Polyvinylpyrrolidone, alumina porous piezoresitive Nano cantilever sensor platform for the detection of change in resistance and resonance frequency. Its surface is further modified porous alumina as a sensing layer. The surface fictionalization is confirmed by OMINACANT and contact angle measurements. The sensor demonstrated a maximum resonance frequency response of 1200 KHz toward change in resistance 80kΩ with time 20 Nano seconds. High Sensitivity values change in resistance depends on the type of analyte and material coating respectively, are achieved.*

1. INTRODUCTION

Nano cantilever sensors as of late utilized for physical, concoction and natural detecting. Nano cantilevers can be utilized for both static and element estimations in fluid or in gas stage. These sensors have a few preferences in the region of therapeutic, especially for the perception of illnesses, detecting of point varieties, blood glucose observing and detecting of compound and organic fighting operators. These sensors have numerous advantages over the current diagnostic methods as far as great affectability, minimal effort, general methodology, low analyte necessity (in µl), non-unsafe strategies and quick reaction. Besides, the nano innovation has been created in the two decades for the manufacture and utilization of cantilevers for identification applications, in this manner giving more significance to MEMS/NEMS. The ebb and flow market has definitely expanded as far as possible up to the specific that analysts can now envision the quantity of atoms. In view of the capacity of extortionate throughput investigation of analyte and ultra-delicate discovery, the present innovation seizes gigantic undertaking for the up and coming era of little and exceedingly touchy piezoresistive Nano cantilever sensors.

2. Characterization Of Cantilever Using Optical Profilometer And LASER Doppler Vibrometer

Since exhibit cantilevers for the most part experience the problem effects of the issue of stiction, other single cantilevers were tried for vibrometry. Discharged cantilever were confirmed utilizing optical profilometer. LASER Doppler vibrometry was utilized for different portrayals identified with cantilever sensors. For this manufactured cantilever were examined utilizing microelectrodes of "Polytec, MSA500 smaller scale sys-analyzer" vibrometer. This was finished by examining one anode on SI substrate and another cathode on cantilever base. At that point sinusoidal waveform was connected to these two cathodes which offer ascent to voltage driven vibrations as a consequence of capacitive impact between cantilever body and Si substrate. Vibrations of cantilever were tested utilizing recognition of sign produced by impedance amongst episode and reflected LASER from the cantilever body. Reverberation recurrence of cantilever was observed to be 543 kHz. Time area investigation was likewise done to comprehend damping conduct of cantilever. Consideration

was taken to do examining at ~10 time more prominent recurrence than the reverberation recurrence of cantilever.

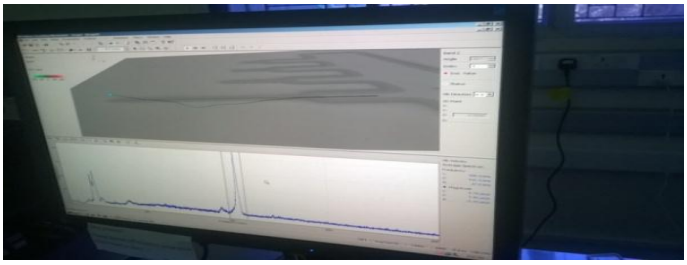


Fig -1: Resonance frequency plot

1.1Ominicant Experimentation analysis

Understanding the interaction of Acetone (VOC) and ethyl acetate with Polyvinylpyrrolidone coated piezoresistive NANO cantilever surface using OmniCant platform experimentation.

1.1.1 Materials

Cantilever, Nitrogen gas, Acetone as analyte and Toluene solvents. Cantilever coated with Polyvinylpyrrolidone

1.2 Preparation:

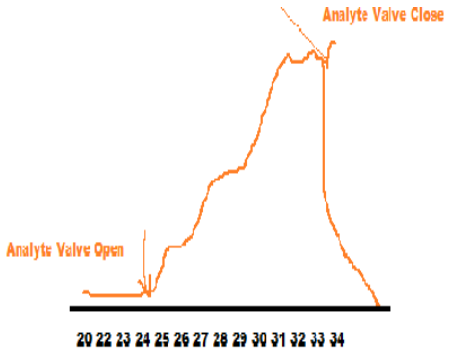
20 nm Gold layer was sputter saved on the cantilever for thiol immobilization.

1.3 *Preparation: Coating Polyvinylpyrrolidone Method*

Polyvinylpyrrolidone was utilized for immobilization. The gold covered cantilevers were submerged in 6 mM arrangements of 4-MBA in ethanol as indicated schematic in Fig. 2. Following 12 hours the cantilevers were washed with ethanol and dried in air.

Observation and Analysis-1

Acetone response curve upon exposures to the si coated device (Representational)



Observation and Analysis-2

Acetone analyte response curve upon exposures to the Polyvinylpyrrolidone coated device (Representational)

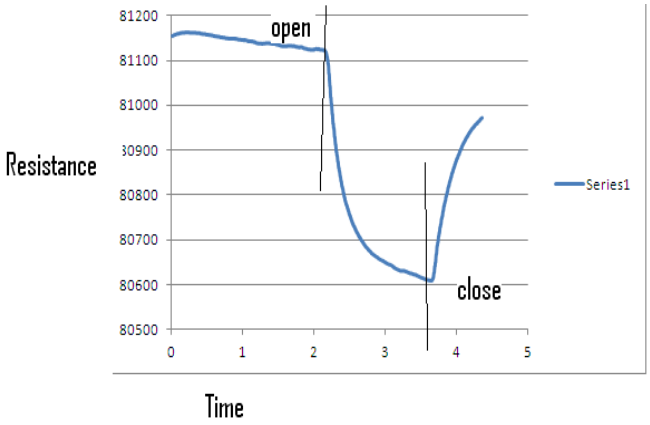
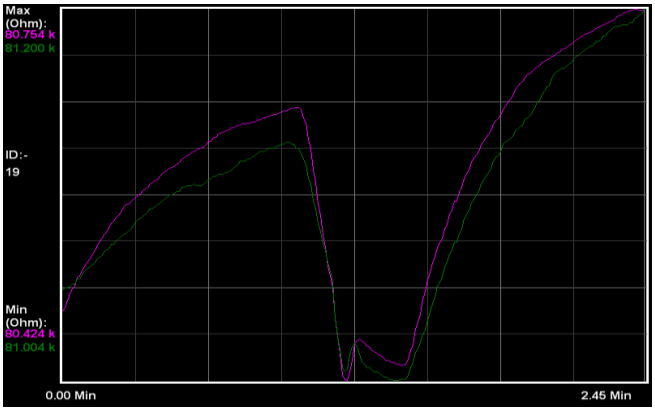


Fig -2: Nano cantilever with Alumina porous coating with analyte acetone result



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Observation and Analysis-3

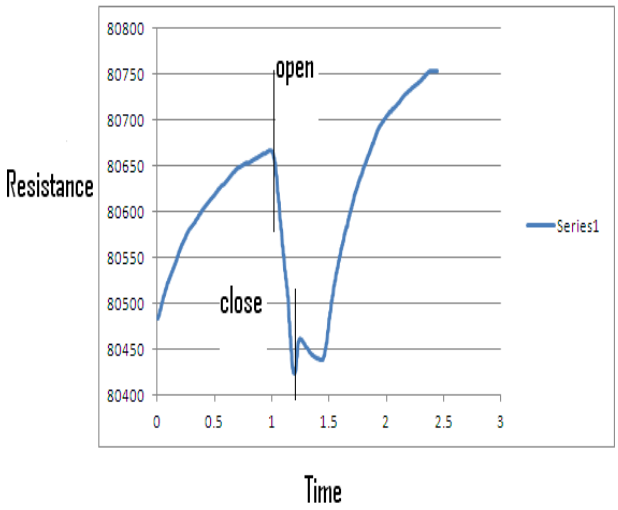
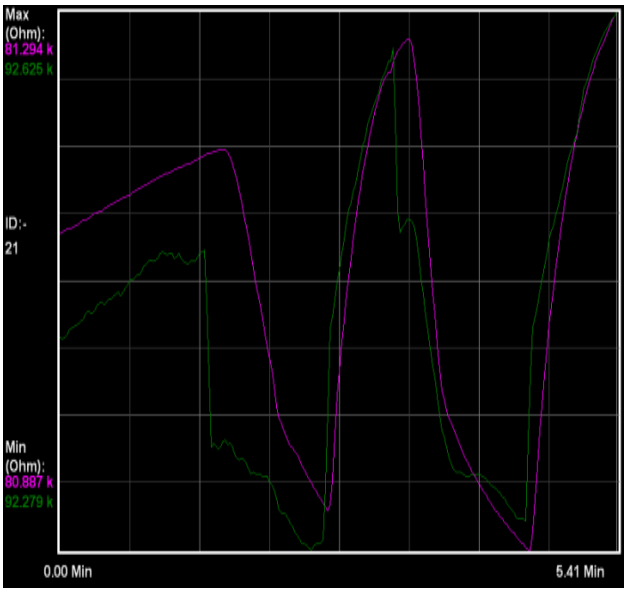


Fig -3: Ethyl acetate analyte response curve upon exposures to the Polyvinylpyrrolidone coated device (Representational)



CONCLUSION

A nanoelectromechanical cantilever was fabricated by surface micromachining convention. It was portrayed utilizing LASER Doppler vibrometer and found to have 1200 kHz Resonance frequency. The present examination was completed from Omnicant the surface fictionalization is affirmed by OMNICANT and contact edge estimations. The sensor showed a greatest Resonance frequency reaction of 1200KHz toward change in resistance 80kΩ with time 20 nano seconds. High Sensitivity values change in resistance relies on upon the analyte substance and material covering individually is accomplished. At last acetone with permeable Polyvinylpyrrolidone nano cantilever will give better resistance for dangerous recognition applications.

ACKNOWLEDGEMENT

The authors would like to acknowledge the funding received from the Department of science Technology (DST), Government of India, through the Research center, Department of Electronics and Communication Engineering, STJIT- Ranebennur. We also wish to acknowledge special support from Prof.shivalingappa, Department of Chemistry, STJIT-Ranebennur, India for providing Analyte solution and for coatings of the cantilever and facility to measure different parameters.

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