



# **DESIGN AND ANALYSIS OF IMPLANTABLE NANOTUBE BASED SENSOR FOR CONTINUOUS BLOOD PRESSURE MONITORING**

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# Objective

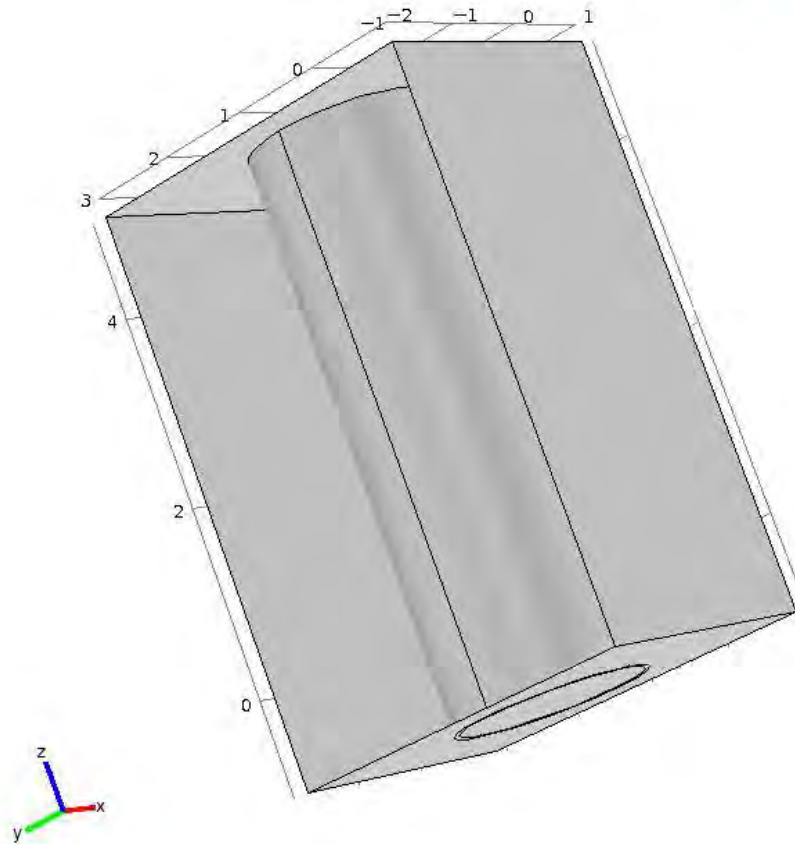
- Design and Analysis of Implantable nanotube based sensor for continuous blood pressure monitoring - sensitivity



## Introduction

- Blood pressure- force which is exerted by the blood on the walls of the blood vessels
- BP-expressed - Systolic/diastolic (120/80)(mmHg)
- Sphygmomanometer – common device
- Continuous monitoring – kidney failure, stroke affected person
- Using nanotube based sensor

# Structural design



Nanotube based sensor



## Contd...

- Base – polyurethane
- Nanotube - One end fixed- other end suspended
- Nanotube has the high young's modulus and high tensile strength
- Act as advantage



# Working

- Blood flow
- Deflection
- Making a reference point – for normal BP
- Displacement of the nanotube greater or smaller compare to the reference



# Design parameters

- Length
- Thickness
- Material



# Simulation and Analysis

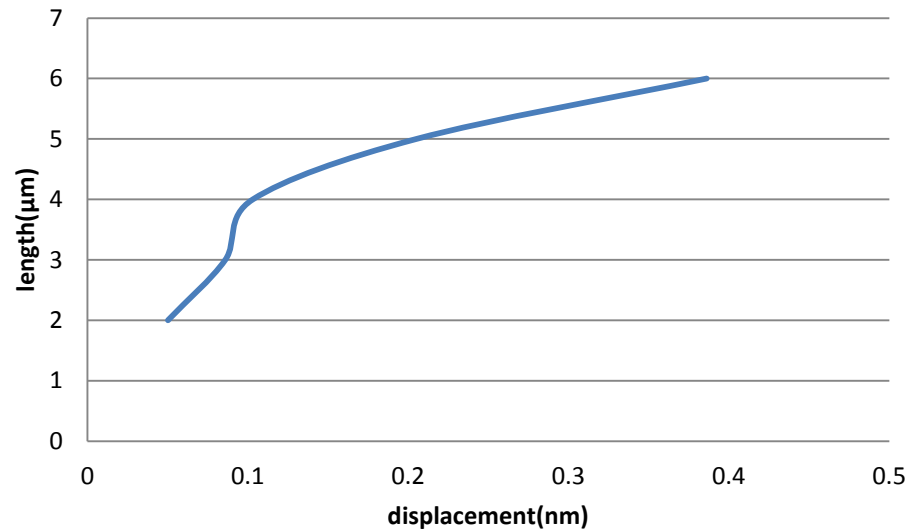
- Physics applied – solid mechanics
- By varying the parameter – results can be analysed



# Effect of change in length

- Thickness- 50 nm, material – carbon, pressure-16 Kpa

displament (nm)	length( $\mu\text{m}$ )
0.05014	2
0.085915	3
0.10309	4
0.20511	5
0.38615	6



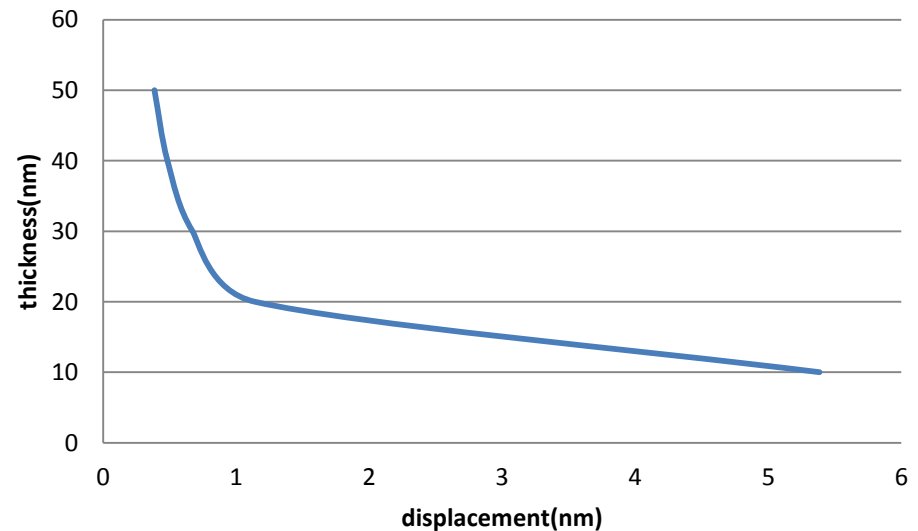
Effects of change in length on sensor performance

# Effect of change in thickness

- Length – 6  $\mu\text{m}$  , material – carbon, pressure-16 Kpa

**displament (nm)    thickness(nm)**

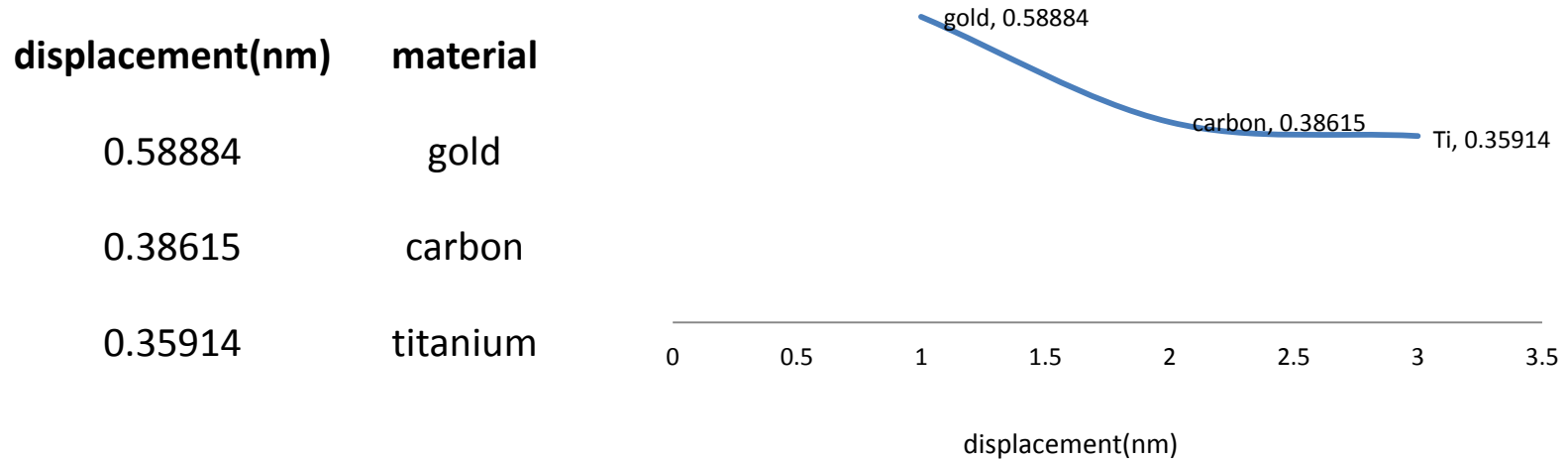
5.3847	10
1.1393	20
0.6723	30
0.48385	40
0.38615	50



Effects of change in thickness on sensor performance

# Effect of change in material

- Length – 6  $\mu\text{m}$  , thickness- 50 nm, pressure-16 Kpa



Effects of change in material on sensor performance



# Result

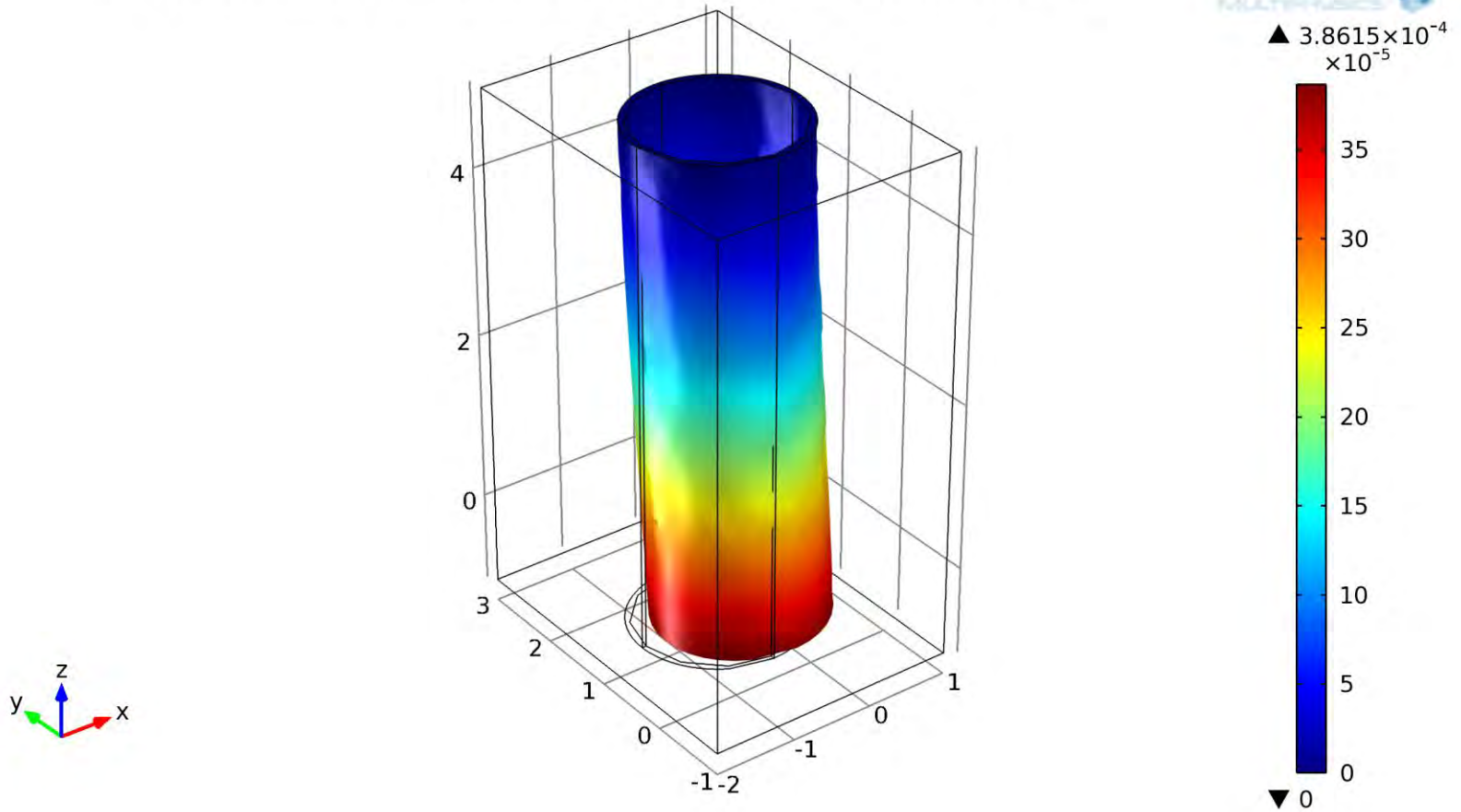
- Length – 6  $\mu\text{m}$  , thickness- 50 nm, material- carbon

pressure (mmHg)	displacement(nm)	pressure(Kpa)
80	0.26547	11
90	0.28961	12
120	0.38615	13
140	0.45855	14
150	0.48268	15

Pressure vs displacement

# Results of simulation

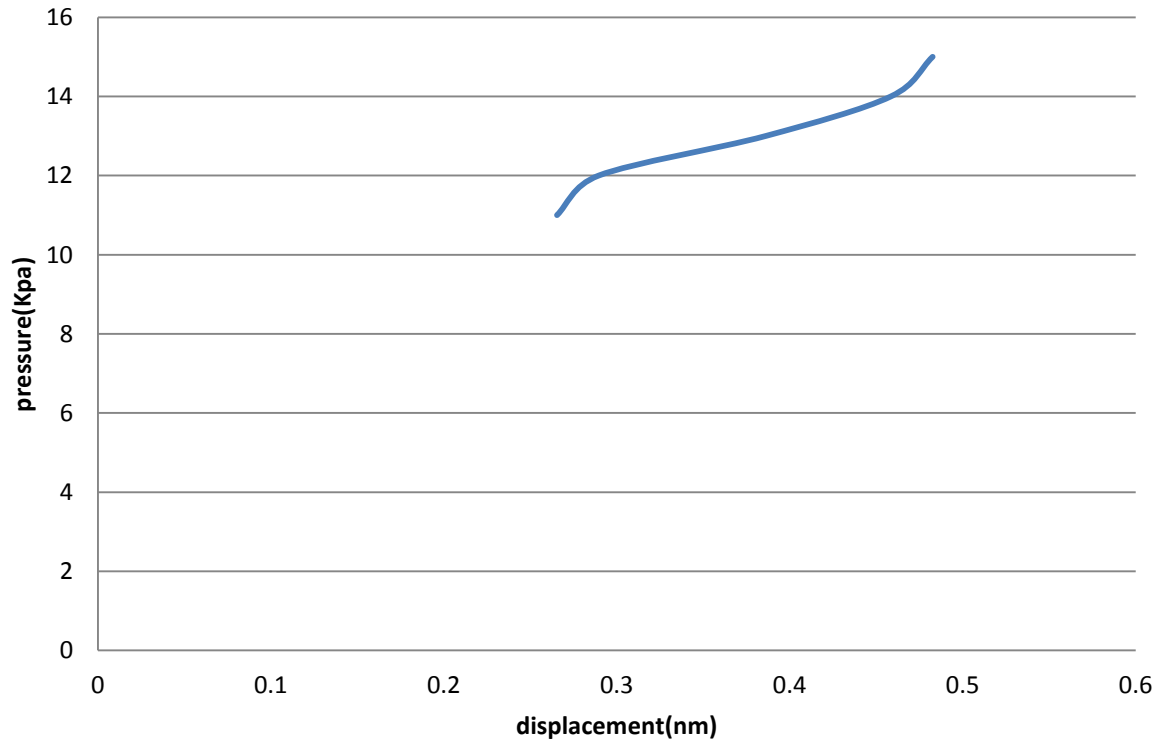
Surface: Total displacement ( $\mu\text{m}$ ) Surface Deformation: Displacement field





# Contd...

Graphical representation of displacement of the nanotube corresponding to the applied pressure





## Conclusion

- Material – gold shows high sensitivity
- Material – biocompatible
- Functionalize



## Reference

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Thank you