

SIMULATION OF 3D MEMS BASED PRESSURE SENSOR FOR SLEEP DISORDER

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Introduction:

The Zinc oxide (ZnO) Nanowire and Aluminium nitride Nanowire based sensors offers high sensitivity and has the ability to detect Sleep Apnea since it leads to the fluctuations in the oxygen level, in turn affect the heart rate and blood pressure. Sleep Apnea is a sleep related breathing disorder that involves a decrease or complete halt in a airflow. The breath rate is considered as the input pressure for the piezoelectric nanowire that converts it into voltage. This relationship between pressure and output voltage was used to make a pressure sensor. This nanowire sensor conveys a real time data with the aspect of minute size and economical cost.

Computational Methods:

when the amount of breath rate completely halts for several seconds to several minutes for more than 20 to 30 times, then the total displacement is measured by comparing normal breath rate. Pressure was applied with respect to the breath rates. This means that, as the pressure increases and more bending occurs in the nanowire. The physics interfaces that used are piezoelectric devices and structural mechanics.

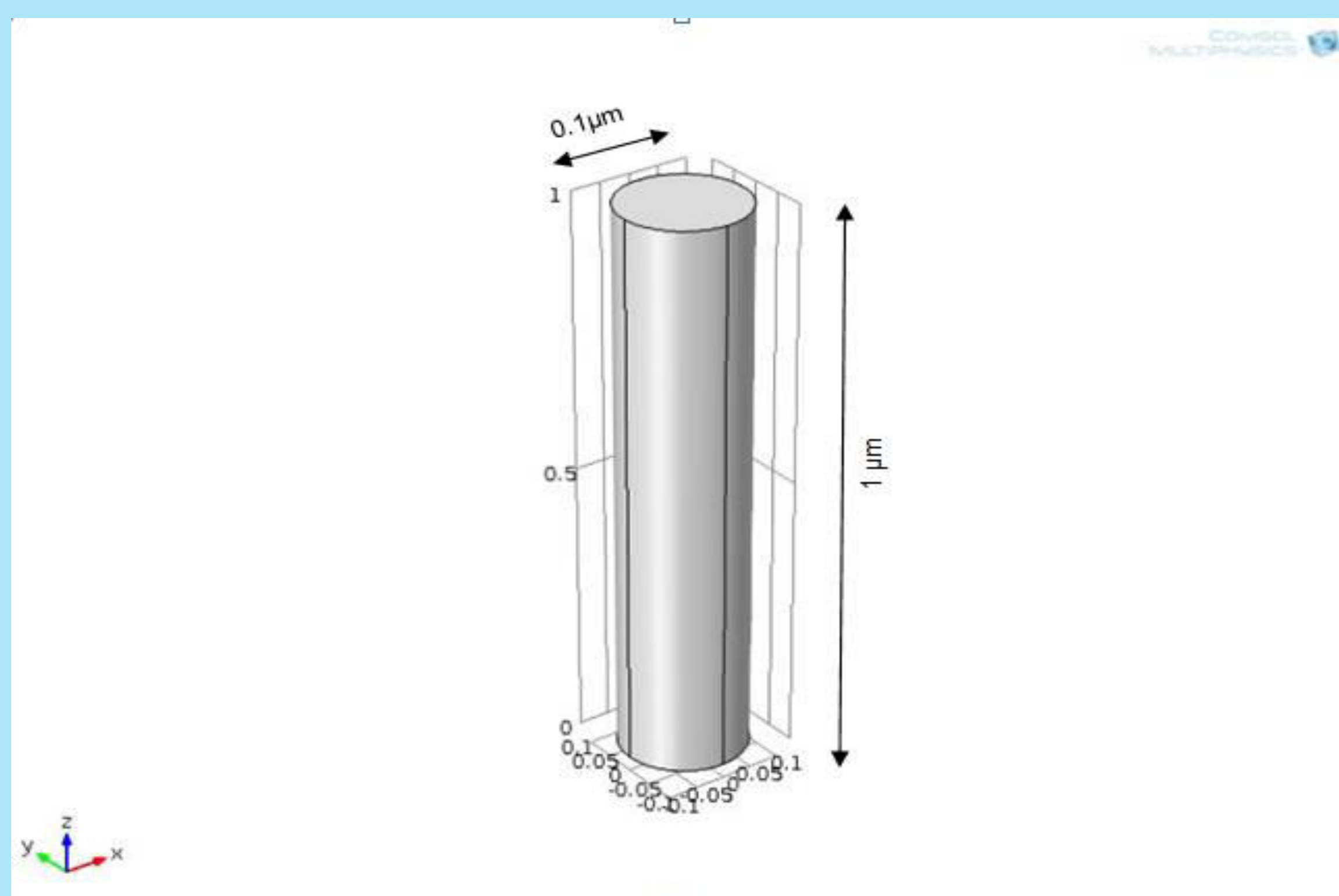


Figure 1. Geometry of Zinc Oxide(ZnO) Nanowire

Results: The breath rate of 95 mmHg was converted and applied as the input pressure. The simulated result is explained with the help of piezoelectric properties like total displacement and total potential. For the best sensitivity nanowire is varied with Zinc Oxide (ZnO), Aluminium nitride.

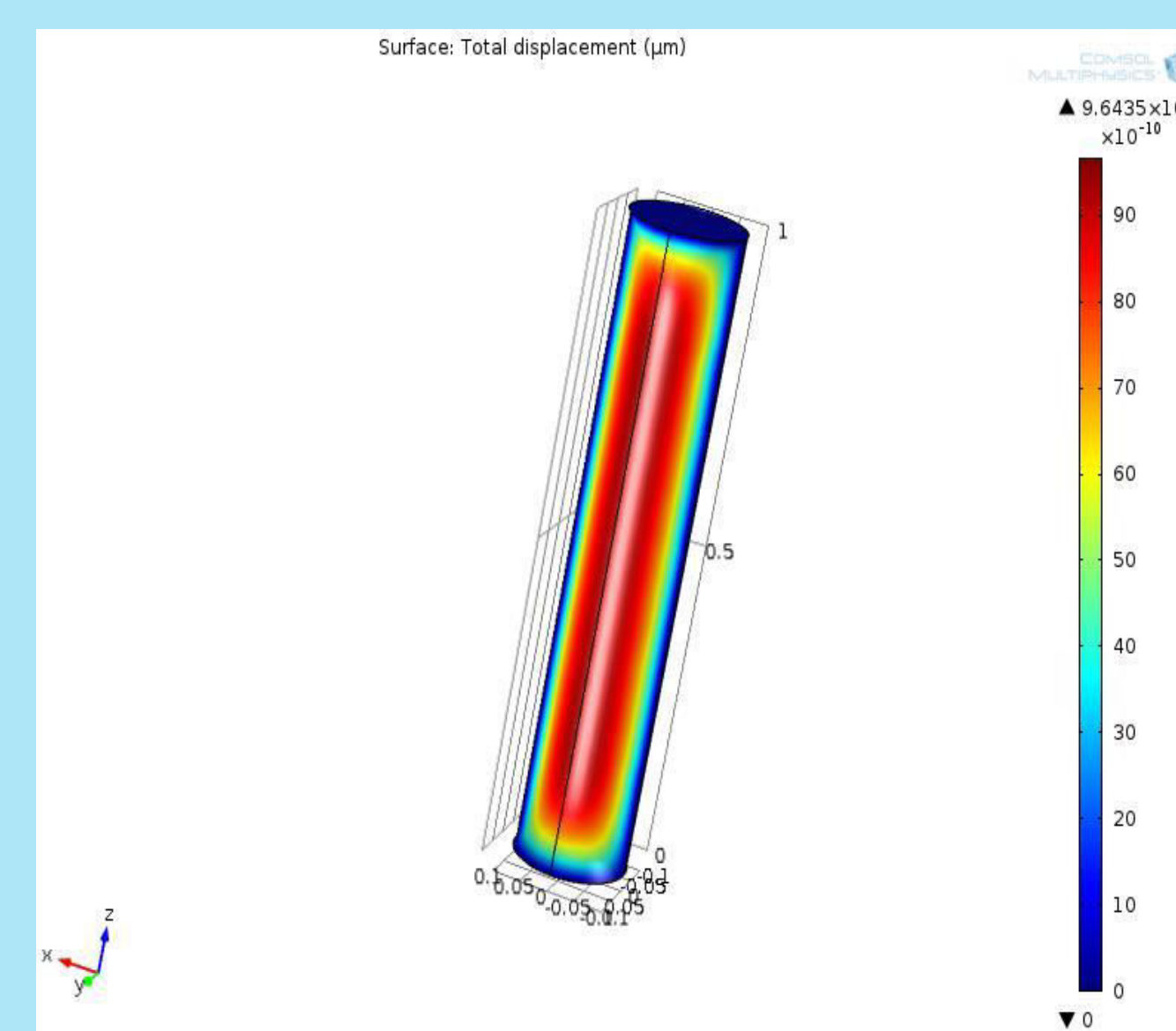


Figure 2. Total displacement

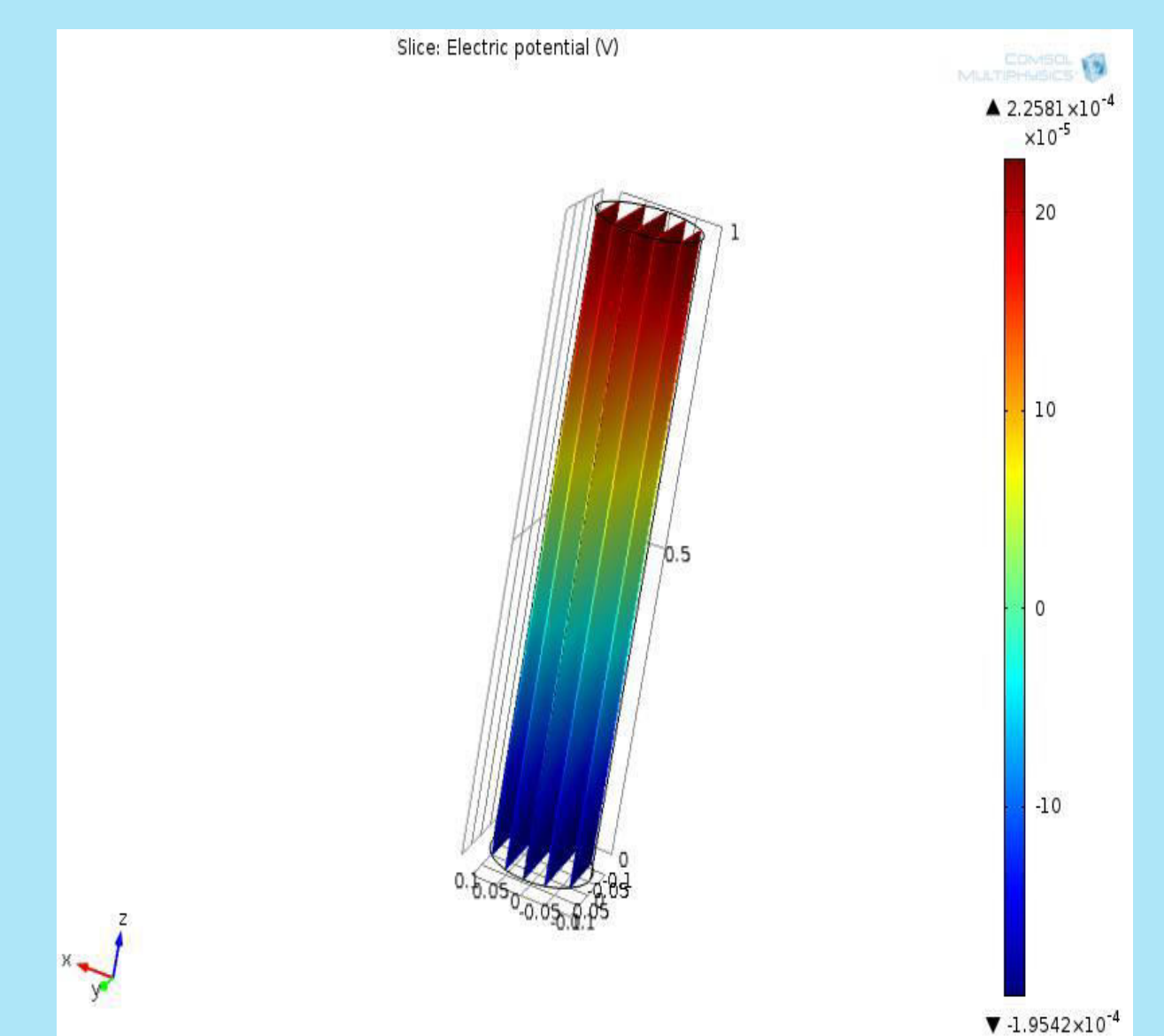


Figure 3. Total potential

Materials applied	Pressure (N/m ²)	Total displacement	Total potential
Zinc Oxide (ZnO)	12665.62705	9.6435*10 ⁻⁹	2.2581*10 ⁻⁴
Aluminium Nitride	12665.62705	5.2064*10 ⁻⁹	1.3615*10 ⁻⁴

Table 1. simulation result

Conclusions: Thus the simulation was executed and the performance of the Zinc Oxide(ZnO) is high when compared to Aluminium nitride.

References:

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