

Studies of Lead Free Piezo-Electric Materials Based Ultrasonic MEMS Model for Bio Sensor

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Background

To prevent complications in diabetes, accurate monitoring and timely management of blood glucose levels is essential.

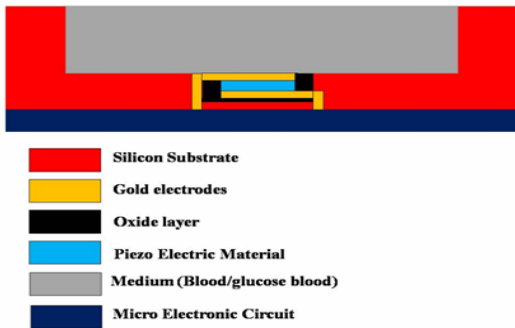
Proposed Work

An ultrasonic transducer that can monitor glucose levels of human blood

Piezoelectric transducer with different lead free piezoelectric materials like (Ba₂NaNb₅O₁₅) (BNN), (BaTiO₃) (BT) and Lithium Niobate (LiNbO₃) (LN).

The potential of 10 Volt with 140 KHz frequency was applied to the device.

Simulation Study:



Schematic diagrams of layer structure of Ultrasonic Transducer MEMS

Results: Response of **BT** is better than **BNN** and **LN** (Ref Table)

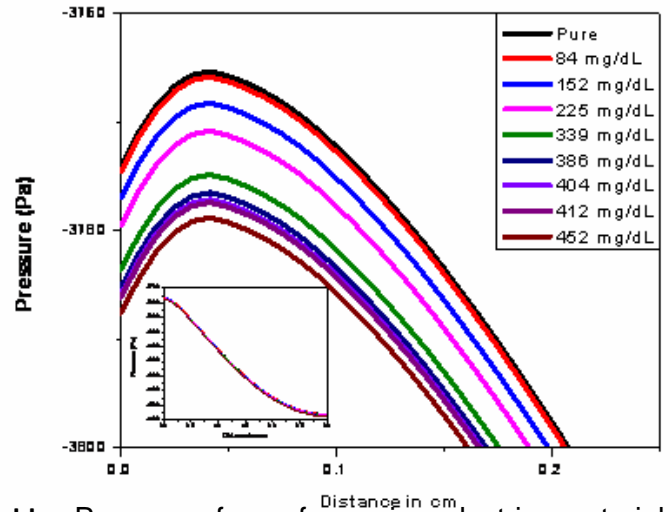
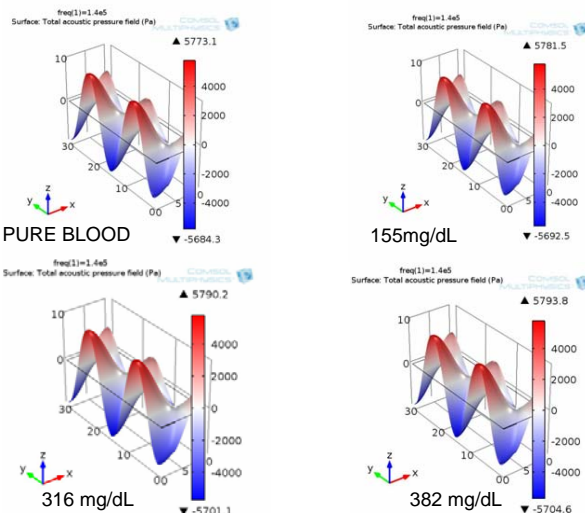


Table Pressure from free piezoelectric materials based devices due to blood sample.

| Blood sample | Pressure generated by LIN (Pa) | Pressure generated by BNN (Pa) | Pressure generated by BT (Pa) |
|--------------|--------------------------------|--------------------------------|-------------------------------|
| 1 | -255.2156377 | -1564.508718 | -3765.337914 |
| 2 | -255.2495062 | -1564.715697 | -3765.832407 |
| 3 | -255.4140098 | -1565.721021 | -3768.234204 |
| 4 | -255.590608 | -1566.800254 | -3770.812553 |
| 5 | -255.8663893 | -1568.485608 | -3774.838906 |
| 6 | -255.9800878 | -1569.180438 | -3776.498856 |
| 7 | -256.0236318 | -1569.446543 | -3777.134575 |
| 8 | -256.0429846 | -1569.564811 | -3777.417116 |
| 9 | -256.139748 | -1570.15615 | -3778.829811 |

Conclusions:

Simulation study using COMSOL Software is done with BT, BNN and LN piezoelectric materials based ultrasonic transducers which has an edge over PZT material as all are free from lead content and hence are bio compatible.

References:

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