

# **MEMS Based Sensor for Blood Group Investigation**

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## **Abstract**

This article describes the design of MEMS based cantilever structure intended for determination of blood group and it is compared with manual method such as specific gravity method and Simuth haemoglobin method. Cantilever structure design has a sensing layer and when a blood sample comes in contact with this, results in coagulation. The surface tension in turn occurs due to chemical and biological reactions of antigen and antibodies resulting in coagulation on the surface of the three cantilever beams of a structure. The deflection is inversely proportional to the applied stress. The surface stress on cantilever makes it to bend and this deformation helps in determination of blood group along with RH factor. The structure of blood group determining sensor is designed and simulated using COMSOL Multiphysics®.

## **Reference**

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- [2] Ana Ferraz, Filomena soares, "A prototype for blood typing based on image processing", R & D centre, Algoritmi, University of Minho, Portugal.
- [3] Stephen A, Mackintosh, James I, Rodgers, Stephen P, Blythe, "Modeling an Enzyme Based Electrochemical Blood Glucose Sensor", Lifescan Scotland Ltd, Inverness, IV2 3ED, Scotland.
- [4]. Priyadarshini, Ramya, kalayvarasi, kalpana, suthathira, "A novel approach in identification of blood group using laser technology", Tamilnadu India.
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## Figures used in the abstract

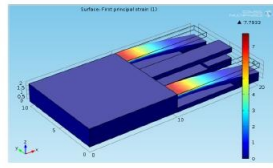


Fig. 6. A+ blood group

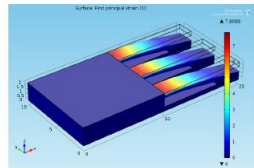


Fig.10. AB+ blood group

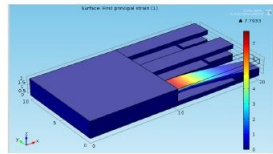


Fig.7. A- blood group

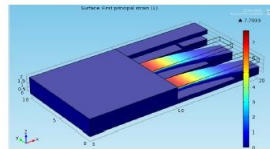


Fig.11. AB- blood group

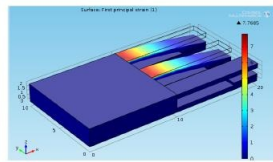


Fig.8. B+ blood group

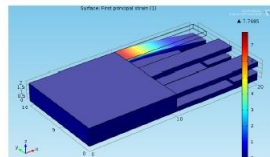


Fig.12. O+ blood group

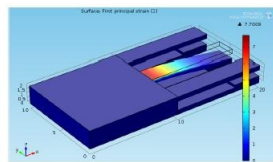


Fig.9. B- blood group

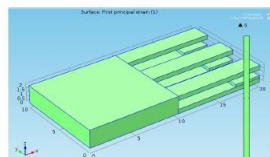


Fig.13. O- blood group

**Figure 1:** Different Blood Group Determinations Based on Deformation.

| X (Stress) | Y(Stress) | Z(Stress) | Deflection |
|------------|-----------|-----------|------------|
| 10.8       | 9.0       | 1.9       | 6.43       |
| 10.97      | 0.95      | 1.98      | 6.28       |
| 12.2       | 1.0       | 1.9       | 4.82       |
| 13.7       | 0.8       | 1.7       | 3.14       |
| 15.8       | 1.04      | 1.5       | 1.39       |

**Figure 2:** Stress Variation Against Deflection in A-ve Blood Group.

| <b>Blood group</b> | <b>First cantilever</b> | <b>Second cantilever</b> | <b>Third cantilever</b> |
|--------------------|-------------------------|--------------------------|-------------------------|
| A positive         | 1                       | 0                        | 1                       |
| A negative         | 1                       | 0                        | 0                       |
| B positive         | 0                       | 1                        | 1                       |
| B negative         | 0                       | 1                        | 0                       |
| AB positive        | 1                       | 1                        | 1                       |
| AB negative        | 1                       | 1                        | 0                       |
| O positive         | 0                       | 0                        | 1                       |
| O negative         | 0                       | 0                        | 0                       |

**Figure 3:** Indication of Type of Blood Group with Binary Outputs.