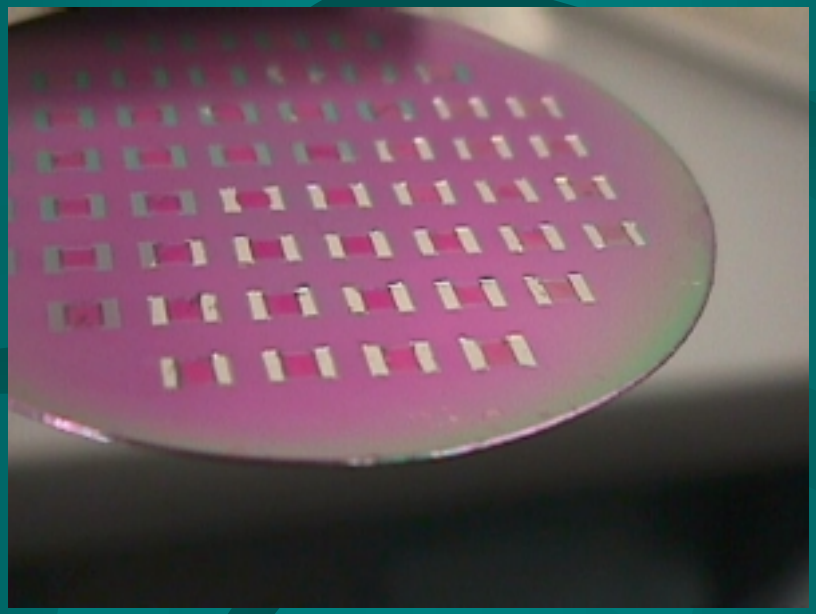
Glucose Sensor Utilizing Silicon Planar Technology



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SUNFEST 2000

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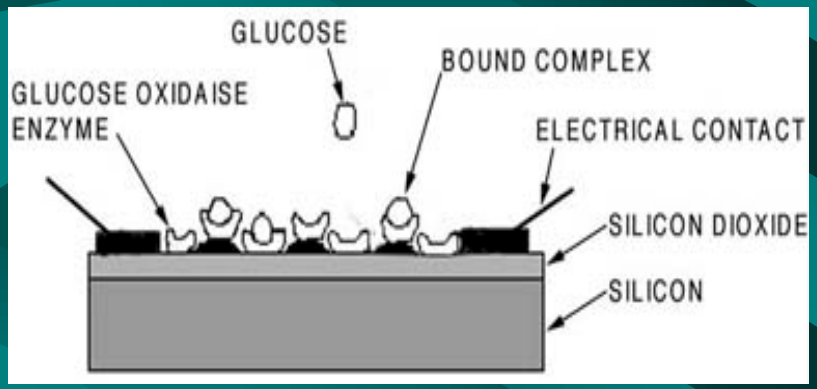
Purpose of Project

- Fabricate a glucose sensor for use by diabetics.
  - Be able to achieve continuous measurements of glucose.
- Evaluate non-invasive methods of measuring glucose levels.

What is a biosensor?

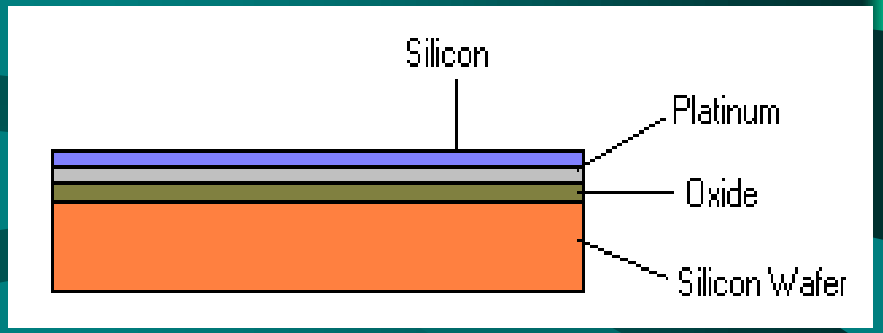
- Analytical device incorporating a biological material.
- Produces digital electronic signal related to the concentration of a chemical.
- Self-contained integrated device.

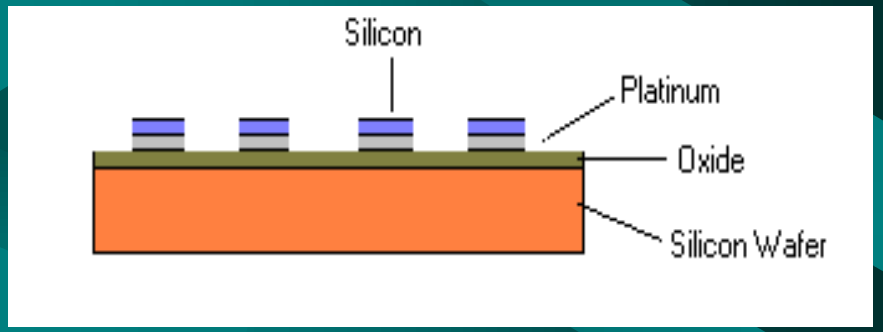


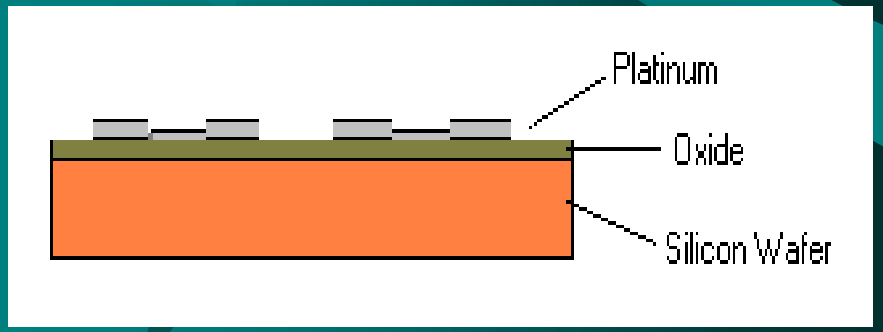
We will use an Enzyme biosensor

Chosen Method

- Silicon dioxide layer
- Platinum bonding pads (contacts)
- Silicon layer serves as a mask.



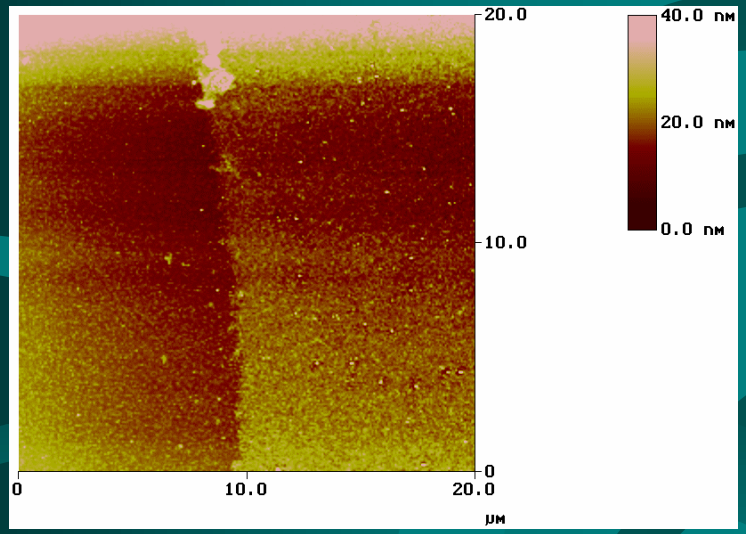


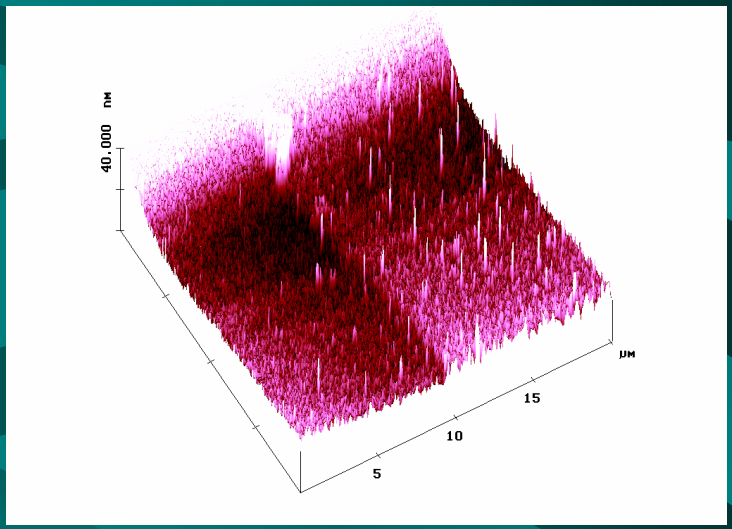


Fabrication

- Deposition of Platinum
  - Sputtering
  - Electron beam evaporation.
- Developing

25-Angstrom Platinum layer

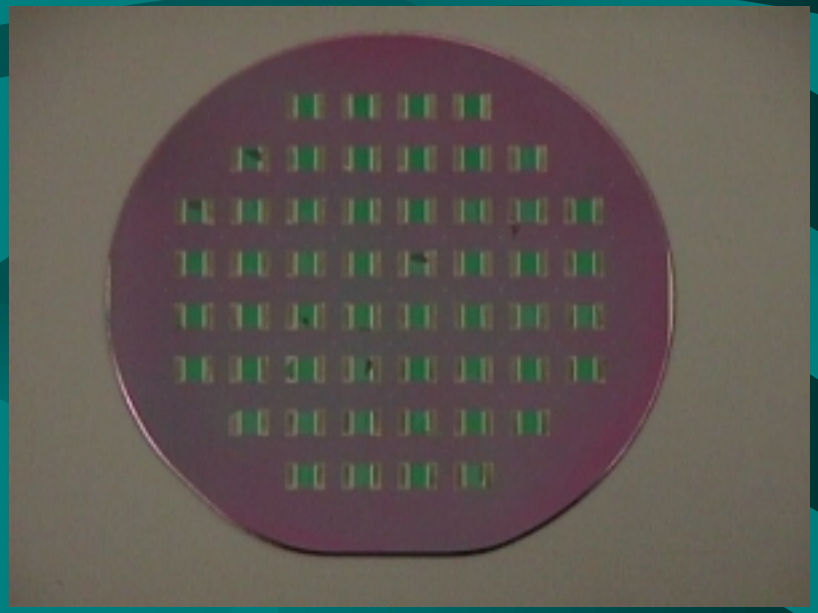




- Top view
- 3-D view of same step at 320 degree rotation

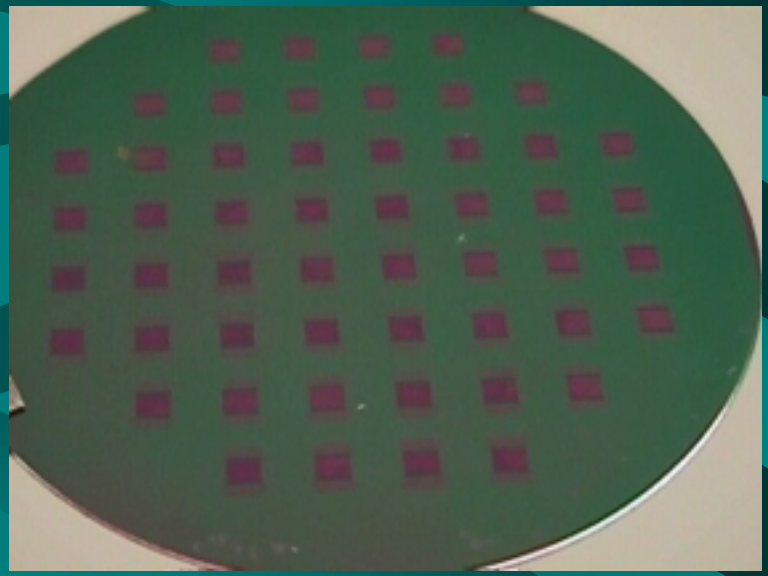
Results

- Not many sensors adhered to the silicon wafer surface.
- Sensitive Sensors
- Three wafers were made at the same time.

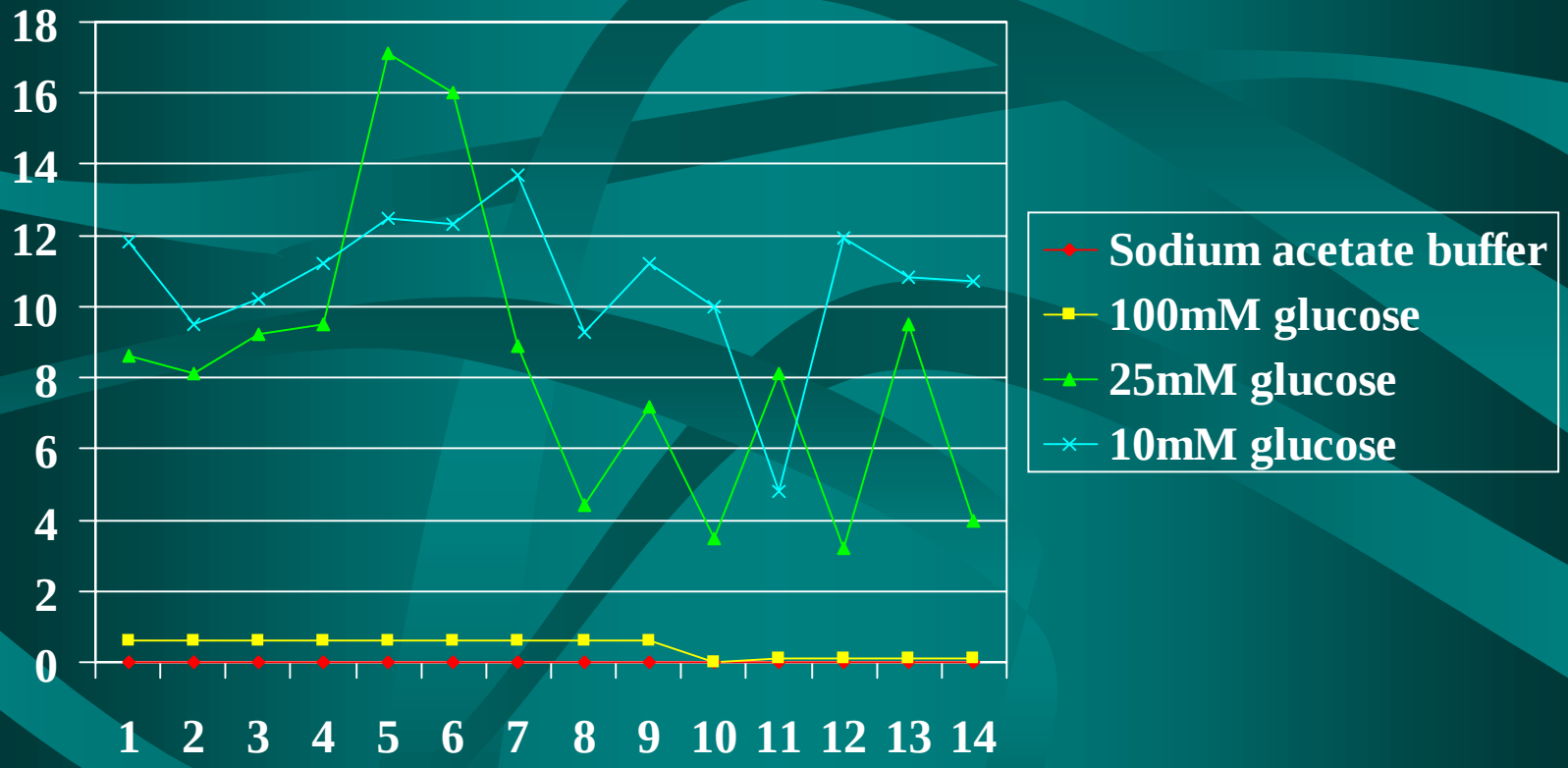


Results

- All sensors adhered to the first wafer.
- No sensors adhered to the second wafer.
- Less than half of the sensors adhered to the third wafer



Sensor Resistance at Various Glucose Concentrations (MOhm)

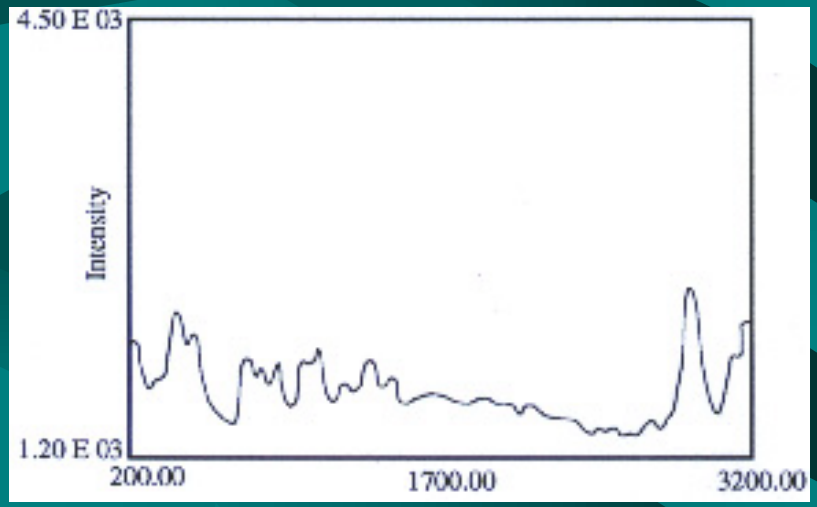


Non-invasive Glucose Monitoring

- Non-invasive glucose sensor
- Feedbacks sensor signal to insulin pump.
- No intervention required from the patient.

Raman Spectroscopy

- Vibrates molecules and measures scattered light produced.
- Each material has a different wavelength and spectrum.
- Material can be determined by spectrum.



Raman Spectrum of a 50% glucose solution.

Other Methods

- Non-invasive glucose monitoring techniques can be classified as subcutaneous, dermal, epidermal and combined dermal glucose measurements
- Infrared Spectroscopy
- Photo acoustic Spectroscopy
- Mid-Infrared Spectroscopy