Porous Silicon Flakes on a Flexible Substrate for Real-Time Biosensing using Smartphone Technology
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Motivation

- **Low Cost Diagnostics:**
  - Cannot rely on expensive lab equipment
  - Must not take long time to get results
  - Especially needed in developing world
  - Smartphones are ubiquitous and can be easily implemented in a point-of-care system

**Meeting ASSURED Criteria:**
- Affordable
- Sensitive
- Specific
- User-Friendly
- Rapid and Robust
- Equipment Free
- Deliverable to Users

[1] Figure: More than half the deaths in the poorest countries are a result of infectious and parasitic diseases

Porous Silicon as a Biosensor

- Porous Silicon (PSi) Properties:
  - Large internal surface area (>100 m²/cm²)
  - Widely tunable pore size (~1 – 100 nm)
  - Easy to fabricate (electrochemical etching)

Operating Principle:
- Multilayer PSi film selectively reflects certain colors of light
- When pores are partially or completely filled, the reflected color changes

Device Fabrication

1. Attach porous silicon to a flat layer of PDMS; place tape on filter paper and spread PDMS across it
2. Peel tape off the paper and place the porous silicon/PDMS unit to paper/PDMS. Bake at high temperature in oven
3. Place device paper first in solution and observe color change

Sensing with Glucose

- Various glucose concentrations
- Detection Sensitivity (DS): 300 nm/RIU
- Smartphone Sensing (PDMS)

Conclusions

- Demonstrated that PSI can be transferred directly onto flexible PDMS or plastic films without compromising spectral integrity
- Presented new approach for low-cost, easy-to-use biosensor using a combination of PDMS, paper, and hydrophobic barriers with PSI and smartphone
- Demonstrated that using RGB data from a smartphone camera can be used instead of a traditional spectrometer to accurately measure sensing events in PSI

References:


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