Porous Silicon based Optical Sensing in Complex Media: Antifouling Coating

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Objective
- Enhance porous silicon based biosensor specificity in serum by preventing nonspecific binding of proteins and contaminants via an antifouling layer.

Introduction

Background:
- Optical biosensors offer several advantages over conventional analytical techniques by enabling direct, real-time and label-free detection of biological and chemical substances.

- Porous silicon (PSi) is a promising nanomaterial for label-free optical biosensing due to its large surface area, ease of fabrication, and convenient surface chemistry.

- Although a lot of progress has been achieved in designing PSi based optical biosensors, most research studies focus on their use in ideal/purified solutions with limited data for applications in complex media³.

Concept:
- Design a PSi based optical biosensor for clinical diagnosis in complex media such as blood or serum.

- Challenge: fouling due to nonspecific binding of proteins in a complex medium interferes with the optical biosensor specificity.

Methods

PSi Preparation by Electrochemical Etch

Antifouling Coating
Polyethylene glycol silane (PEG-SL)

PSi + PEG-SL coating

OPSi + PEG-SL + PBS

Reflectance Measurement

Results

OPSi is more resistant to corrosion compared to PSi.

3. FTIR Spectroscopy: shows peaks consistent with PEG-SL attachment.

Conclusion

- A PEG-SL antifouling monolayer applied on PSi based biosensor helps reduce nonspecific binding in serum by 80%, which improves its specificity.

- The oxidized porous silicon surface showed a higher stability when exposed to serum and phosphate buffered saline (PBS).

Future Work
- Test performance of other antifouling coatings on OPSi.
- Test biotin-streptavidin assay in serum on OPSi.

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References

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