Characterization of a Novel Nanoporous Organosilicate Material for its Potential Use in Biosensor Platforms

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Outline

• Background

• Experimental methods

• Results

• Conclusions and future work
Biosensor Background

- Antibody-based bacterial detection
- Fluorescent tag signals presence of analyte
- LCW - low refractive index channels
- Large surface area
  - increased immobilization → lower detection limit
Background

• Nanoporous Organosilicate
  – Proprietary formulation
  – Ultra low RI dielectric
  – Nanopores (20nm), low RI, methyl groups on surface

• Possible biosensor platform
  – Surface modification necessary
Experimental Methods

• Surface modifications performed:
  – Silanization
    • MTS (3-mercaptopropyltrimethoxysilane)
  – Crosslinking
    • GMBS (N-succinimidyld 4-maleimidobutyrate)
  – Protein immobilization
    • Protein A/AF546
Experimental Methods

- Surface characterization performed:
  - Fluorescence \( \{ \) Control: Si wafer without NPO
  - ATR FT-IR
  - Ellipsometry \( \} \) Control: unmodified NPO
  - SEM

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Results: Fluorescence

Effect of NPO on Fluorescence

Wavelength (nm)

Intensity (cps)

Fluorescence without NPO

with NPO

without NPO
Results: ATR FT-IR

Si peaks

Absorbance

Wavenumber (1/cm)

NPO
modified NPO
Results: ATR FT-IR

![Graph showing ATR FT-IR results with wavenumber (1/cm) on the x-axis and absorbance on the y-axis. The graph compares NPO and modified NPO samples.]

- Absorbance range: 0.000 to 0.020
- Wavenumber range: 4000 to 2500
- NPO
- Modified NPO
Results: Ellipsometry

• NPO refractive index
  \[= 1.17\]

• Modified NPO refractive index
  \[= 1.19\]
Results: SEM

Before

After
Results: SEM

Before

After
Conclusions

• NPO as a biosensor platform
  – RI remains low
    • LCW biosensors
  – Fluorescence enhancement
  – Modification preserves pore structure
  – Chemical structure unchanged

• Future work - antibody based LCW biosensor for detection of bacteria and viruses
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