Optical Detection of Changes in Glass Surface Properties Induced During Wet Photolithography

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Introduction to Lipids and Membranes

- What is a lipid
- Types of lipids
- Why lipid membrane study
- Types of layers

Layers structure:
- Monolayer
- Bilayer

Phospholipid Membrane

Integral Proteins
Wet Photolithography of Lipid Bilayers

\[ \text{O}_2 \xrightarrow{184 \text{ nm}} \text{O}_3 + {^1\text{[O}_2\text{]}_d} \]

\[ \text{RX} \xrightarrow{254 \text{ nm}} \text{R}^+ + \text{X}^- \quad \text{[O]*} \]

(ions, radicals, excited species)

\[ \text{R}^+ + \text{X}^- \xrightarrow{1\text{[O}_2\text{]}_d} \text{CO}_2 + \text{H}_2\text{O} + \text{N}_2 \]
Oblique Incidence Reflectivity Difference (OI-RD)

- Laser
- Polarization Modulator
- Phase Shifter
- UV/O irradiated Layer
- Liquid Cell
- Scan Beam by Translating Substrate
- Substrate
- Ambient
- Detector
- Analyzer
- θ
Effects of Chemical Etching and Subsequent UV/O Patterning

Lipid Bilayer (Piranha Etched)

Bare glass (Piranha Etched)
Homogenizing the Surface

Piranha Etched only
(No lipid involved)

Piranha Etched and UV irradiated
(No lipid involved)
Results With Other UV Exposures

Cleaning → 20 min

Patterning

20 min

40 min

40 min
Verification of the Membrane Properties

- Lipid fused
- Lipid patterned well
- Lipid recovered its mobility
Registry of OI-RD Ellipsometry and Fluorescence Data

Fluorescence Images

Ellipsometry Images
Conclusion

- UV irradiation after chemical etching makes the whole glass surface homogenous.
- The fluidic properties of the lipid membranes are retained.
- The OI-RD label free Ellipsometry technique enabled us to detect these optical changes in the glass surface.
- The technique employed is precisely suitable for wet photolithography applications.
- This approach is perfect for backfilling experiments to study the Protein-DNA interactions in lipid membrane environment.
Acknowledgements

NSF Center for Biophotonics Science and Technology (CBST)

Xiangdong Zhu, Department of Physics, UC Davis
James Landry, Department of Physics, UC Davis
Atul Parikh, Department of Applied Science, UC Davis
Reinhard Bruch, Department of Physics, UNR

This project is partially supported by Nanolife Inc., Reno, NV