Role of Surface Energy, Hydroaffinity, & Topography in Nano-bonding™ of Si(100) with SiOx via a β-cristobalite precursor phase: TMAFM & 3 Liquids Contact Angle Analysis


Background

- From Three Liquid Contact Angle Analysis (3LCAA)
  - Etching will cause water angles to go down and Bromonaphthalene angles to go up. This shows that we are increasing donor/acceptor interactions, but decreasing Van Der Waals interactions.
  - The over-etch makes the surface more wavy on a cm-scale and makes the Nano-bonding contact fail, but that does not necessarily affect surface molecular interactions.
  - Wet anneal compared to a dry anneal shows an increase in the donor value of surface energy at the expense of a minimization of the acceptor value. The more successful rate of wet Nano-bonding shows that OH terminated surfaces are vital to the Nano-bonding process.
  - From correlation of 3LCAA to Atomic Force Microscopy:
    - The total surface energies from 3LCAA match the observed changes in the AFM topographs, while the surface energy components provide insight into the molecular interactions at the surface.

Conclusions

- This shows that we are increasing donor/acceptor interactions, but decreasing Van Der Waals interactions.
- Wet anneal compared to a dry anneal shows an increase in the donor value of surface energy at the expense of a minimization of the acceptor value. The more successful rate of wet Nano-bonding shows that OH terminated surfaces are vital to the Nano-bonding process.
- From correlation of 3LCAA to Atomic Force Microscopy:
  - The total surface energies from 3LCAA match the observed changes in the AFM topographs, while the surface energy components provide insight into the molecular interactions at the surface.

Synthesis

- SiOx via a β-cristobalite precursor phase: TMAFM & 3 Liquids Contact Angle Analysis

ARIZONA STATE UNIVERSITY: Department of Physics, Barrett Honors college, and The Center for Biology and Society

Summary

- From Three Liquid Contact Angle Analysis (3LCAA) we can conclude that the components of total free surface energy which help to better understand the most consistent method of Nano-bonding.

Faculty Mentors

N. Herbots, R.J. Culbertson, J.D. Bradley, R.L. Rhoades, S.N. Drews

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