Study of Octadecylphosphonic acid (OPA) Langmuir Blodgett film interactions with different substrates

RIPON KUMAR DEY (rdey3@uwo.ca)
Surface science western(Uwo.ca/ssw)
Supervisors: Dr. Heng-Yong Nie, Dr. Leo Lau.

I am using "KSV 3000 Langmuir-Blodgett Trough" in western Nanofabrication Facility to deposit LB film on different substrates to pursue my research works

- **Purpose**: *Well-controlled and well-ordered uniform OPA LB film forming on different surfaces and characterizing its mechanical properties and improving its strength through H-Bombardment.*

- **Workstream**:
  1. *Controlling the phase transitions of OPA amphiphilic molecules.*
  2. *XPS study on OPA/Surfaces as a function of coverage(%).*
  3. *Molecular orientation/thickness measurement of OPA/*Surfaces.
  4. *Controlling the domain structure of OPA LB film.*
  5. *Characterization of OPA LB deposited surface* and blank surfaces.
  6. *Surface Energy Estimation of LB monolayer and Cross-link of OPA LB film..*
  7. *Mechanical properties characterization of Modified OPA LB film with HarminX.*

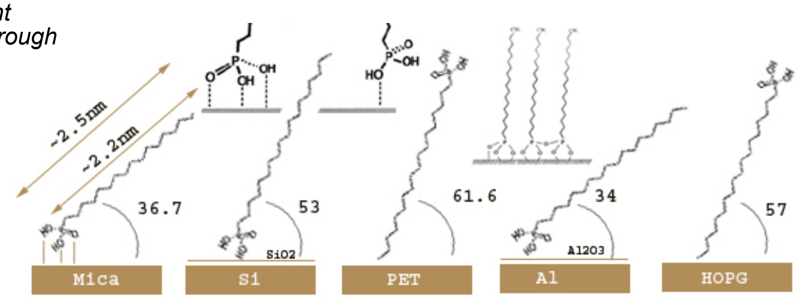


Fig 1: Schematic representation of tilted orientation of OPA molecule and proposed type of bonding of OPA

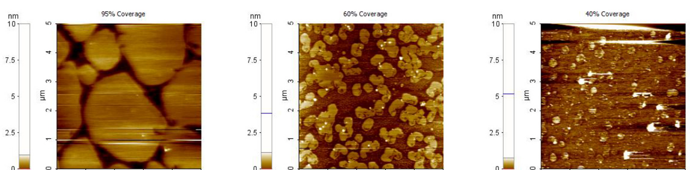


Fig 2: AFM illustrations of OPA LB films in Condensed, Liquid and Solid phases at areas 27cm2, 56cm2 and 95cm2 respectively

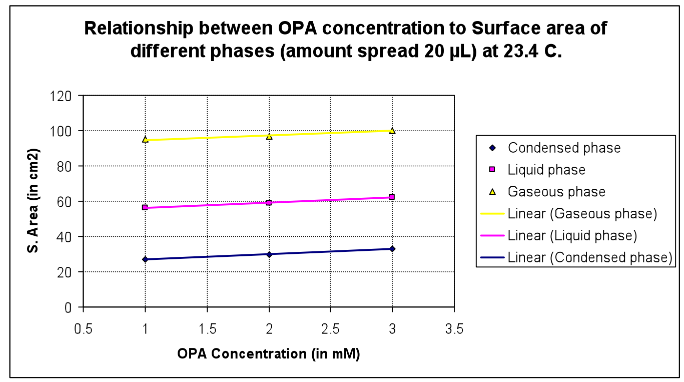
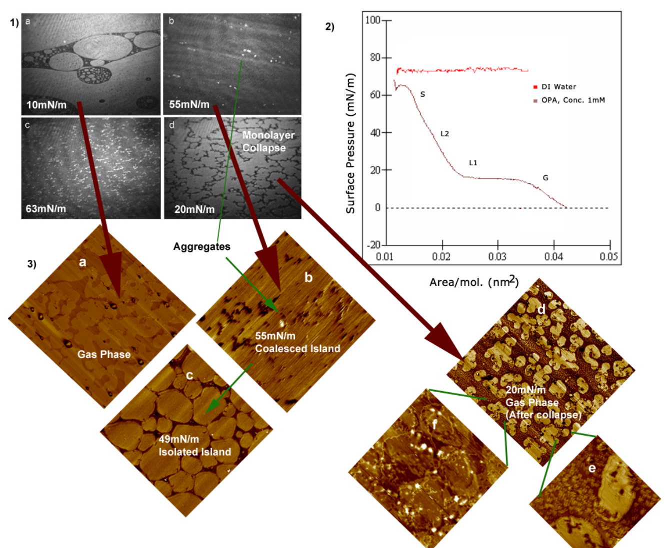


Fig 3: Relationship between OPA concentration and surface area of different phases in temp 23.40C while 20 µL solution was spread over.

BAM (Brewster angle microscopy) images for monolayer on DI water subphase at a) 10mN/m, just after spreading the solution over subphase, b) 55mN/m, in the range of condensed phase, c) 63mN/m just after condensed phase, where collapse started, d) 20mN/m after expanding the monolayer from collapse (63mN/m); **2)** Surface pressure (π)-area per molecule (nm2) Isotherm Curve at 230C of OPA; **3)** AFM images of a) Gas phase, b) Solid phase (Coalesced island), c) Solid phase (Isolated island), d) Gas phase (after collapsing), e) zoomed image of d, f) zoomed image of d where aggregates are seen.



Courtesy: Dr. Dirk G. Kurth for sending me BAM images

Conclusion

1. *P-O-Al bonding make Al (metal surface) strong adsorption with OPA LB film. Conversely, Polymeric surface PET has weak adsorption with OPA.*
2. *Domain structure of OPA LB molecule can be controlled by S.Pressure, temp., and S. area with a function of time.*
3. *For different electronic interactions of OPA on metal structures in comparison with interactions of OPA on atomically flat surfaces, wider line could be found in metal surfaces.*
4. *HOPG was not deposited with a homogeneous OPA LB film.*