



# Quantification of Hydrophobic recovery Temporal Bonding in Polydimethylsiloxane

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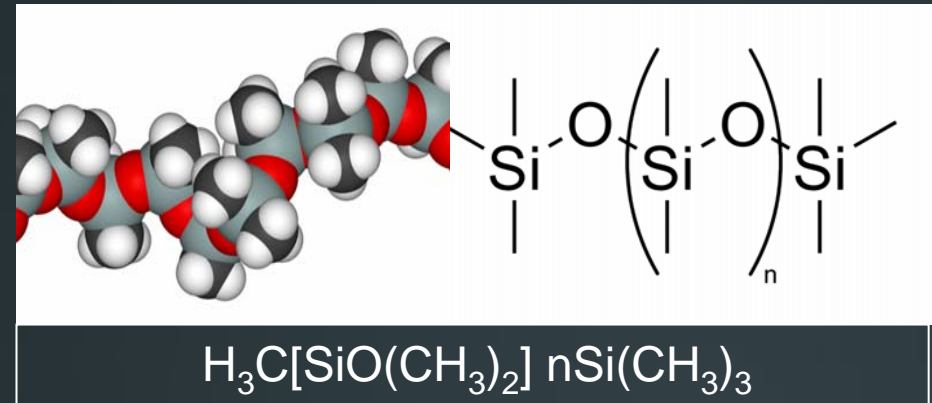
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# P.D.M.S.



- Repeating monomer of  $\text{SiO}(\text{CH}_3)$  units.
- Polymerization causes cross linking.
- Visco elastic polymer (Based on 'n').
- Intrinsically hydrophobic.
- Biocompatible and Oxygen permeable.



# Applications

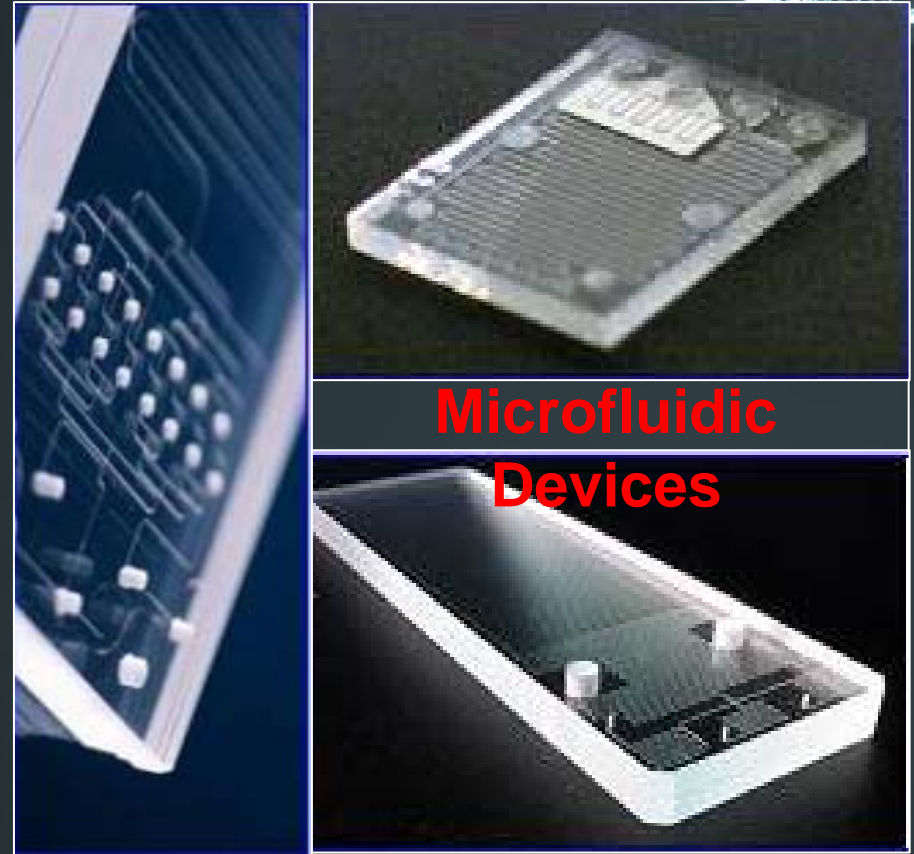
## ➤ Variety of Applications

### ➤ Micro fluidics

- Molds

- Devices

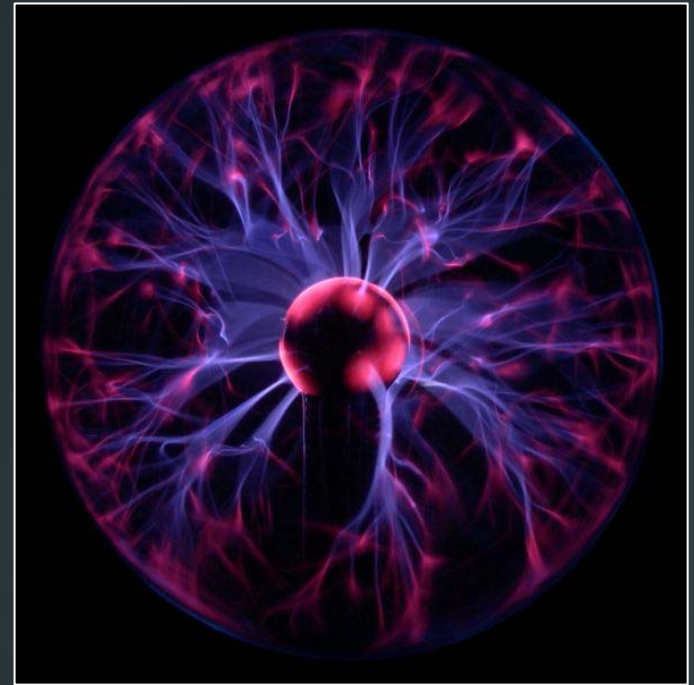
- Brain Slice Device



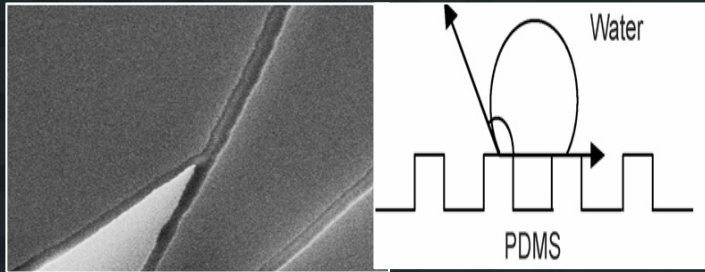
# Background Research



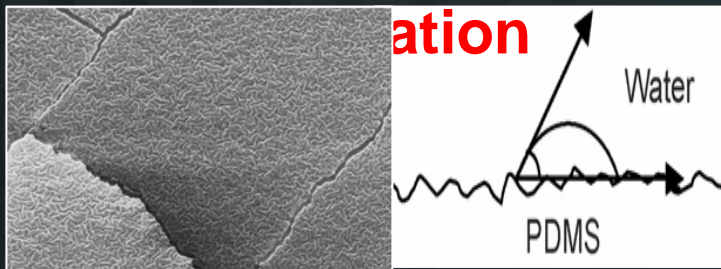
- **Hydrophobic because of the methyl groups.**
- **Applications of PDMS require it to be hydrophilic.**
- **Increased cell adhesion and less repulsion when incubating sample.**



# Plasma Activation

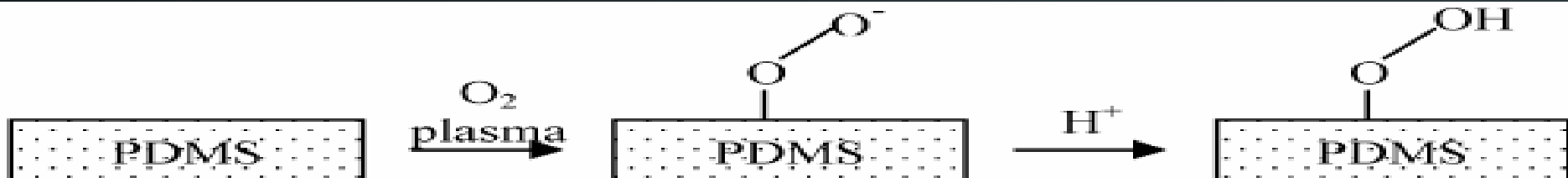


**Before Plasma**

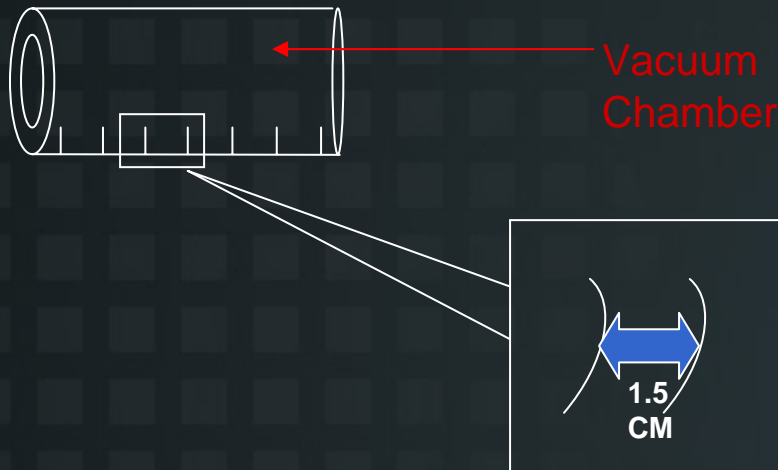


**After Plasma Activation**

- Hydrophilicity due to
- Addition of a Silanol group.
- Alteration of surface Chemistry.
- Never regains its original hydrophobicity due to permanent scarring of surface.



# Plasma Chamber Quantification



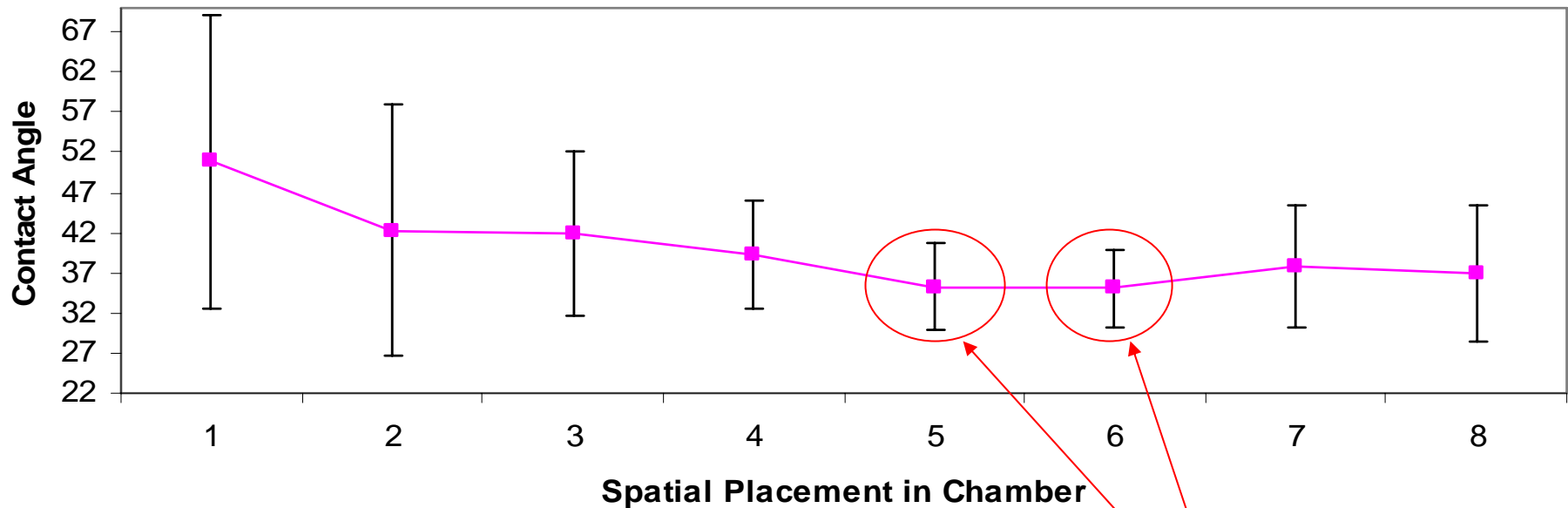
**Schematic Representation  
of the Plasma Chamber**

- **Erratic Behavior of PDMS after plasma activation.**
- **Major instrumentation : plasma chamber.**
- **Non uniform activation of plasma.**
- **Variation – Humidity, atmospheric pressure, flow rate**

# Plasma Chamber Quantification



**Spatial Location vs Contact Angle**



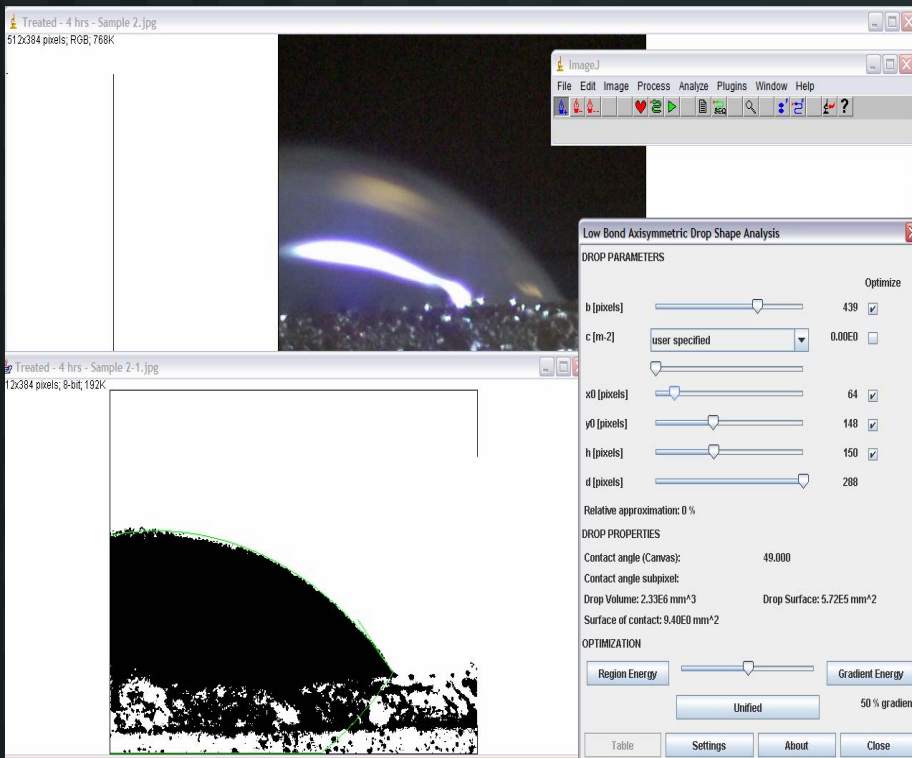
**Least Hydrophobic = Best Area**

# Quantification Experiment



## ➤ Quantification Experiment

- Samples were not aged (10 per time frame).
- Bonding and contact angle was measured.
- Since the samples were not aged, could be used as a control

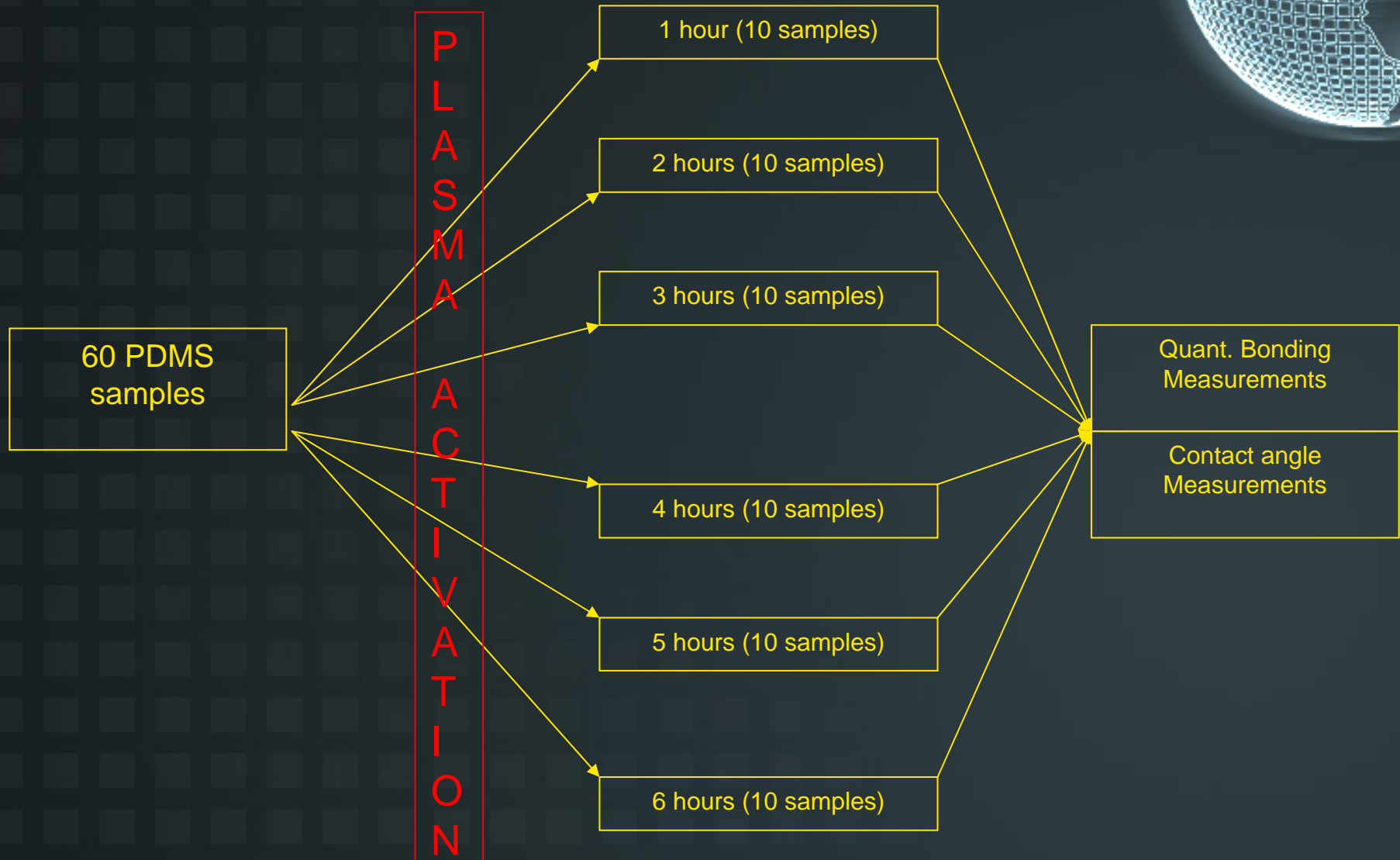


**Image J**

- Image J is used for measuring contact angles



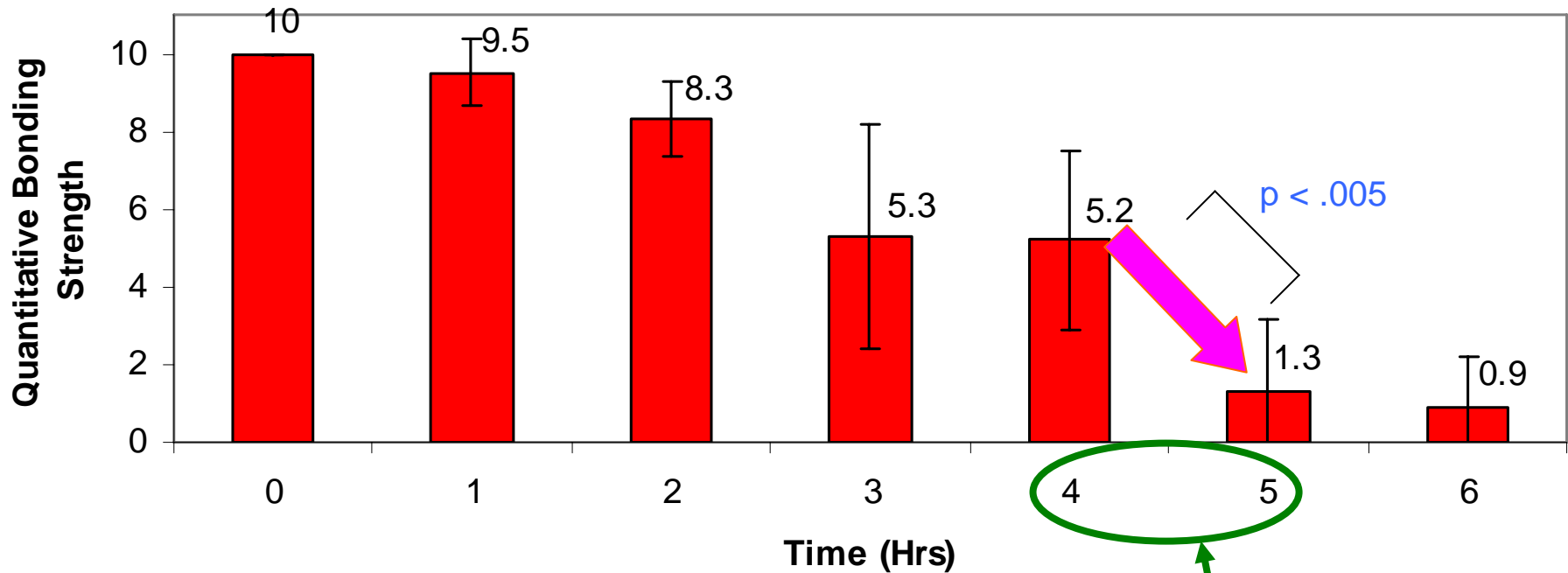
# Schematic



# Quantification Experiment

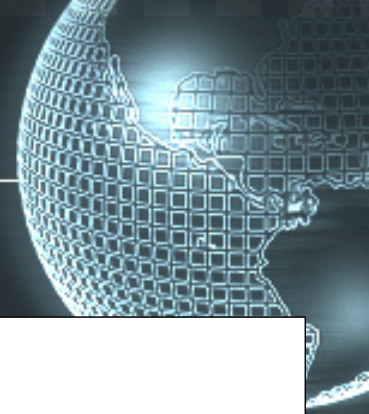


Bonding vs. Time

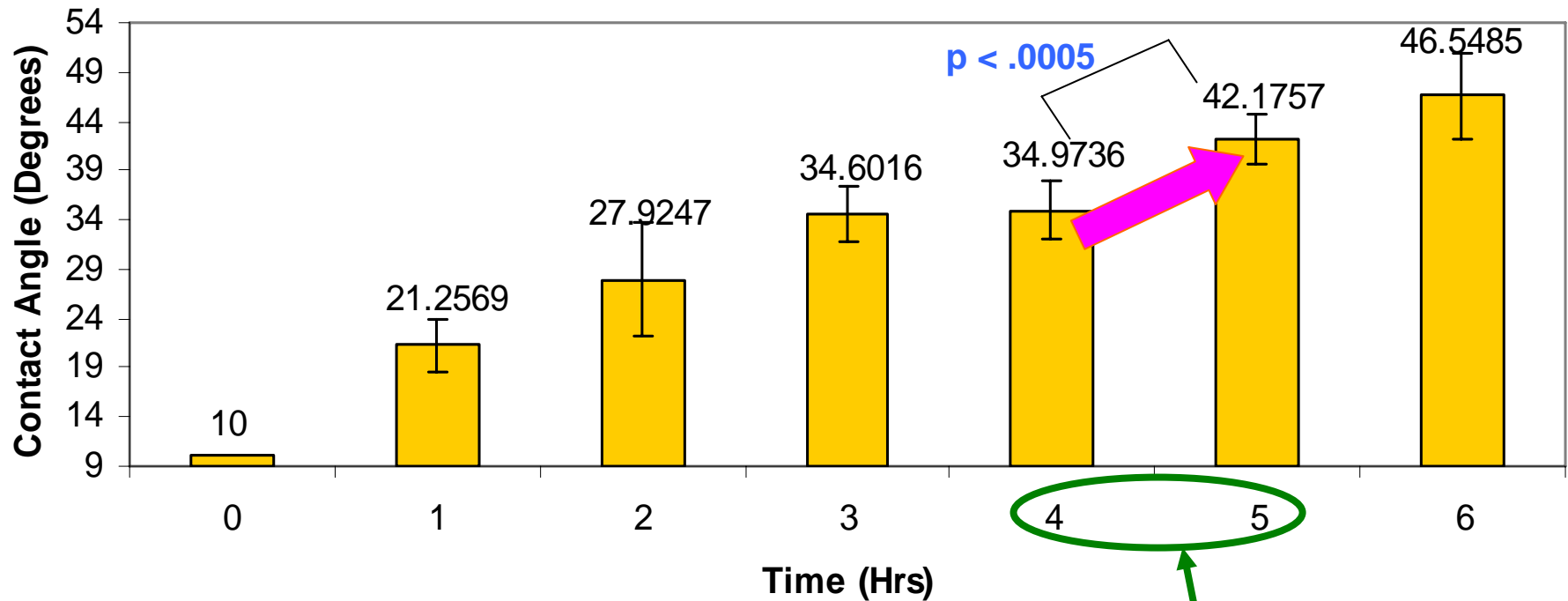


Time frame of interest

# Quantification Experiment

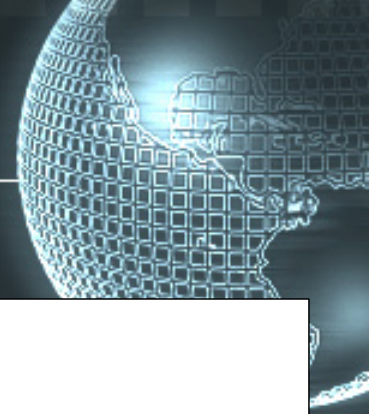


Contact Angle vs. Time

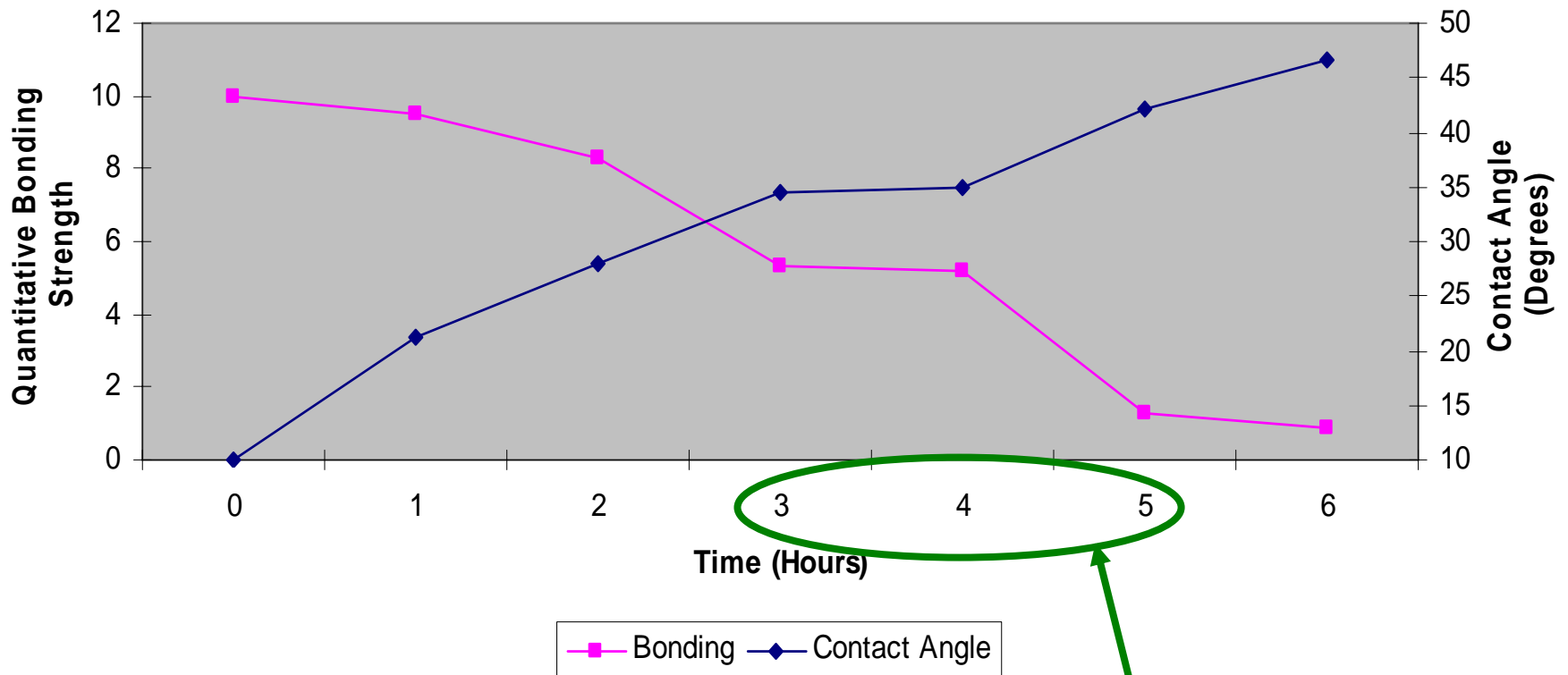


Time frame of interest

# Overlay



## Contact Angle and Bonding Variation with Time



Time frame of interest

# Ageing Experiment

- Test the effect of ageing after plasma activation.
- Ageing before plasma activation decreases the rate of hydrophobic recovery.
- Five samples for each time frame.
- Compared to the control/quantification experiment.

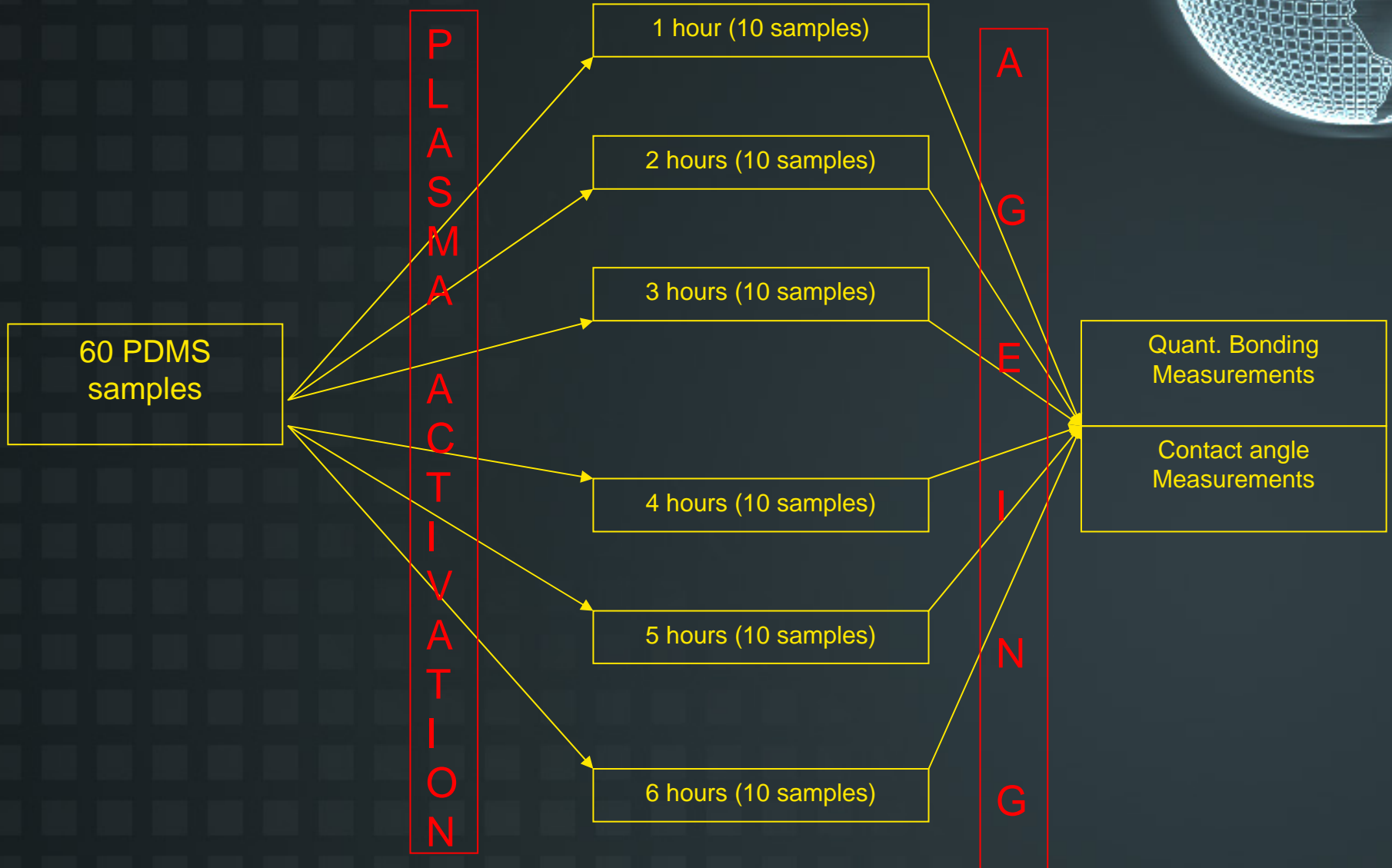


In - house goniometer



Contact angle on a perfectly hydrophobic surface

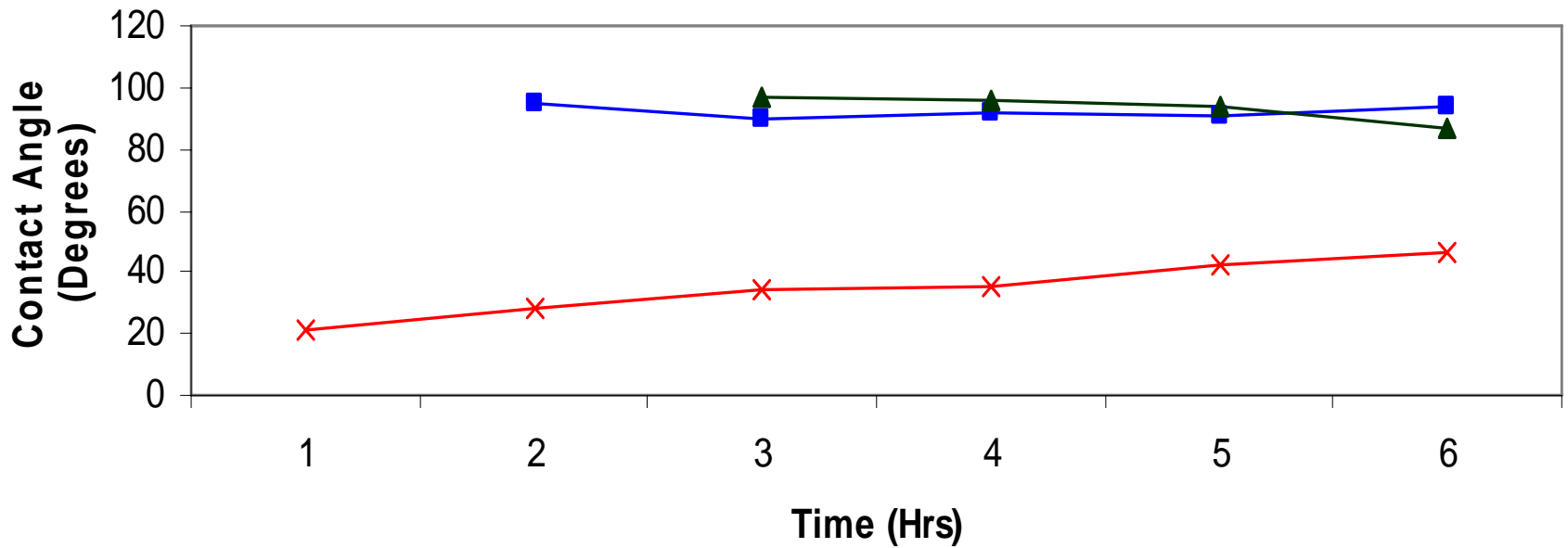
# Schematic



# Ageing Experiment

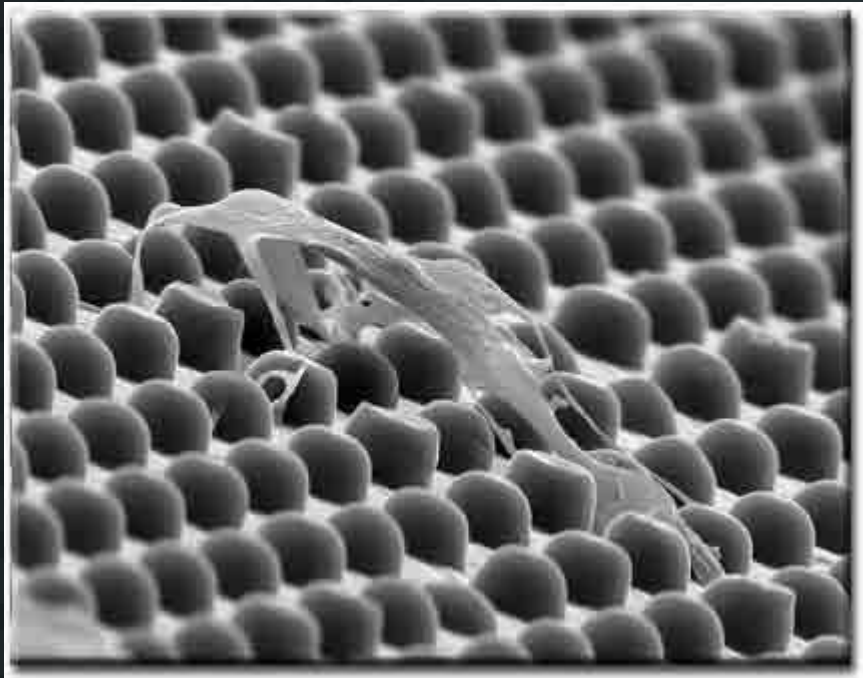


**Contact Angle vs Time**



—■— Aged Sample (1 hr) —▲— Aged Sample (2 hrs) —x— Unaged Sample/ Control

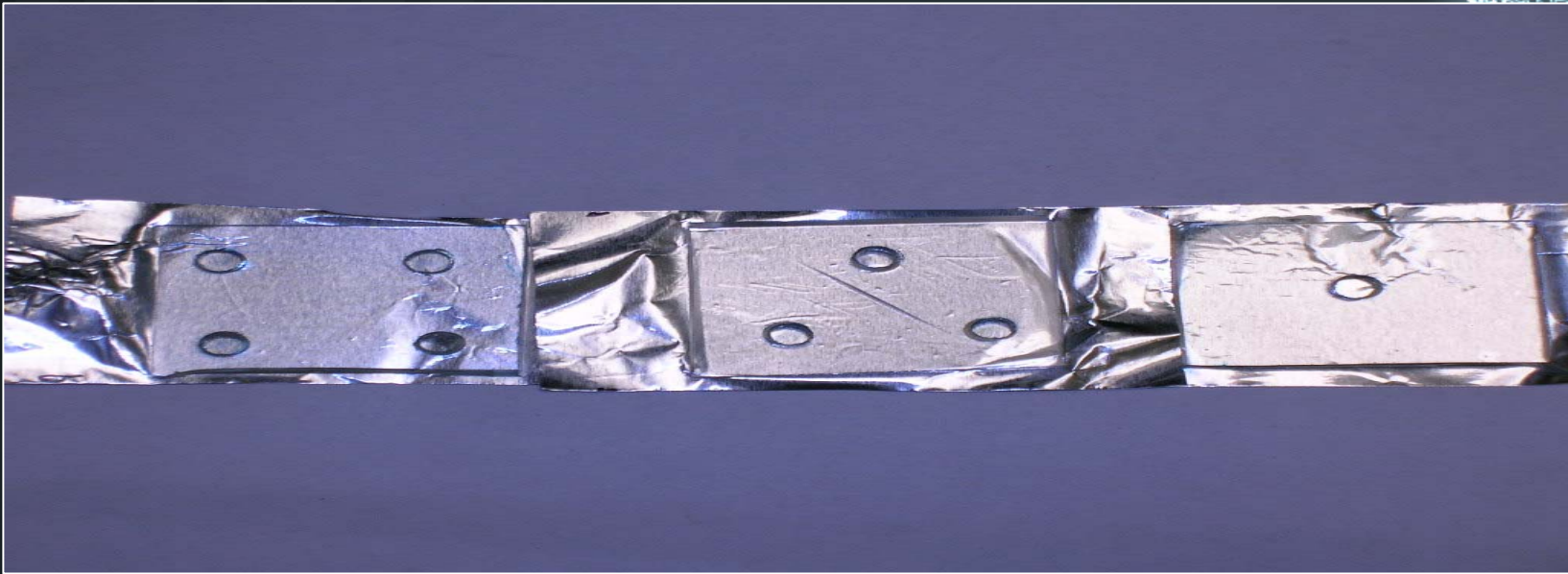
# Ageing Experiment



- Ageing after plasma activation increases the rate of hydrophobic recovery.
- No significant difference between 1 hour aged samples and 2 hours aged sample.
- Indicates that although ageing does have an effect, beyond a certain time frame, length of ageing does not matter.



# Blister Packs



- Self contained environment for micro fluidic liquids.
- Exploits PDMS's strong affinity for Aluminum.
- Non uniform surface of Aluminum causes

# Acknowledgements



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# References



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