Effects of Polystyrene Coating on the Reflectance Spectra of Quasi-2D Perovskite Flakes

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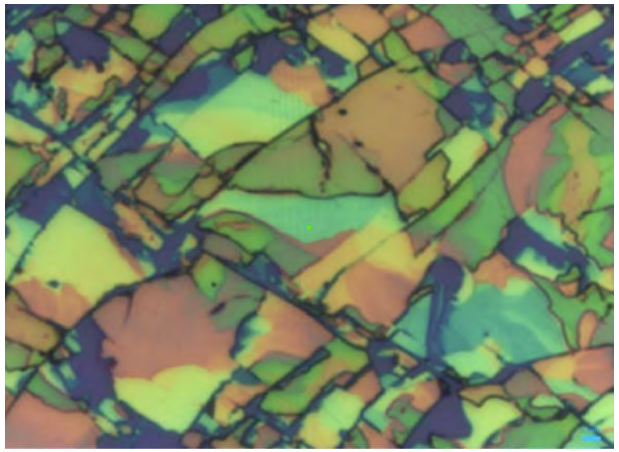
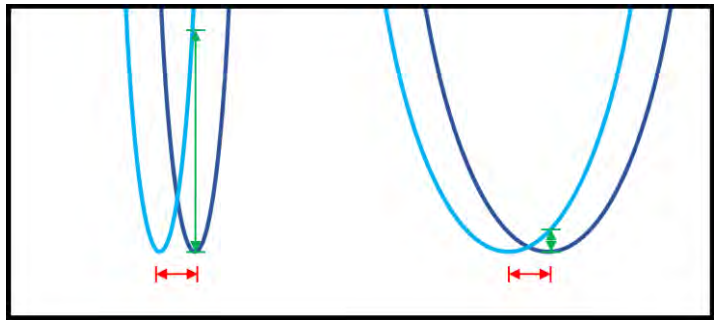
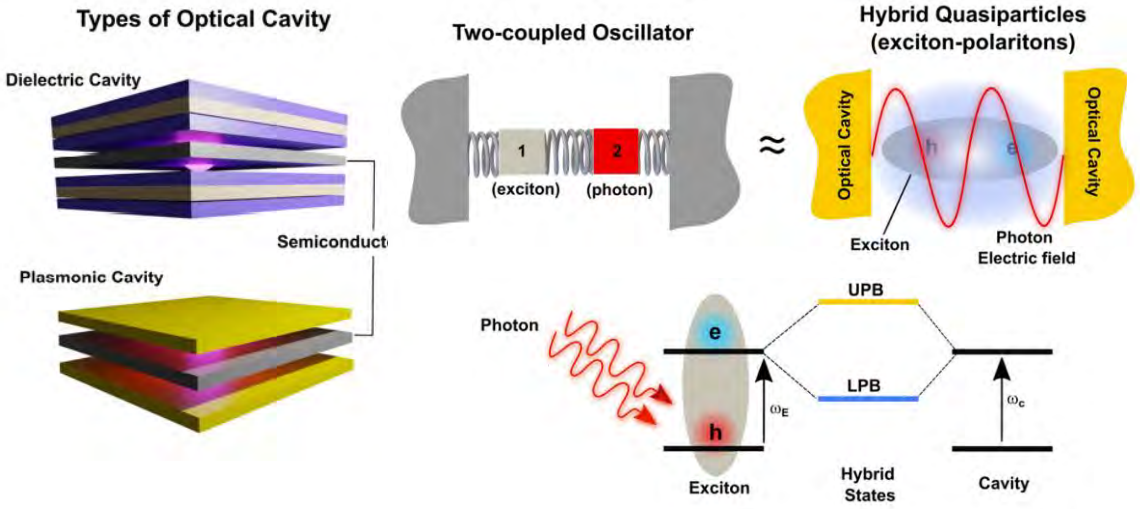
Mentor: Dr. Surendra Anantharaman, PI: Dr. Deep Jariwala, Materials Science and Engineering

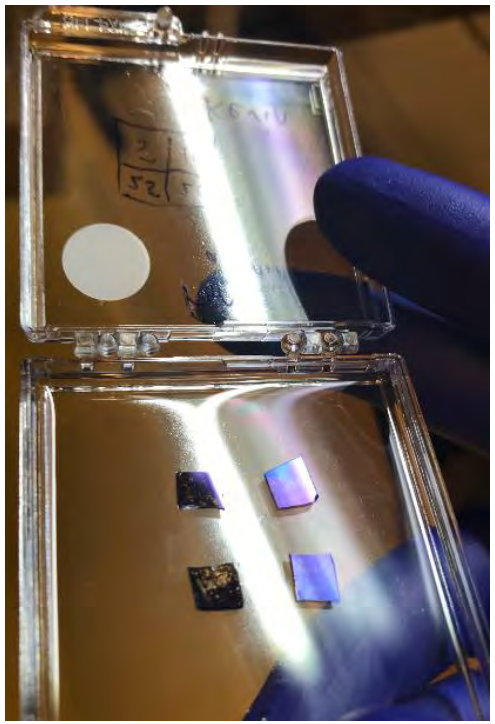
Background: Perovskite Flakes, Sensor Application

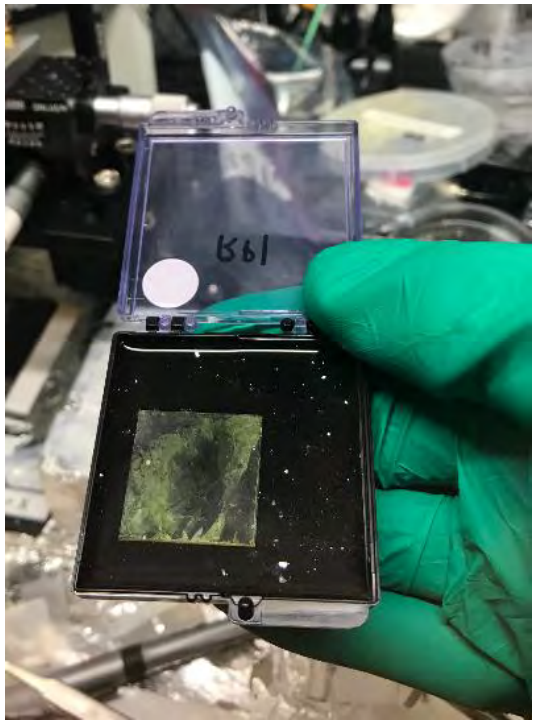


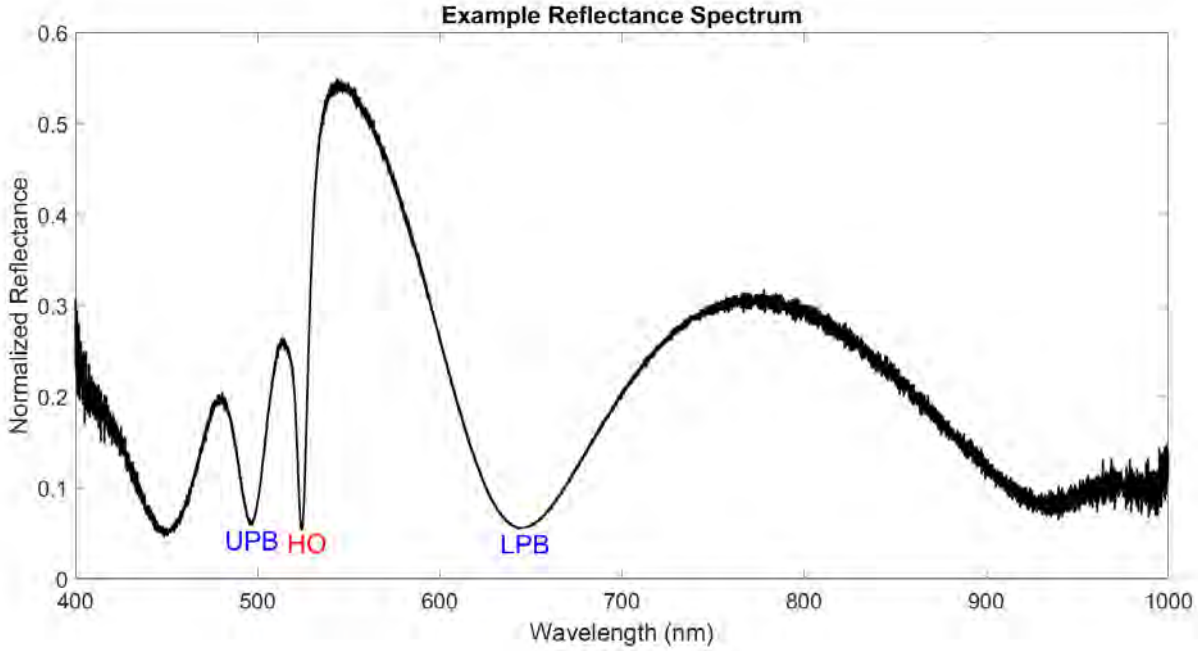




Anantharaman, S., Jo, K., Jariwala, D. "Exciton-Photonics: From Fundamental Science to Applications". *ACS Nano* 2021. DOI: 10.1021/acsnano.1c02204

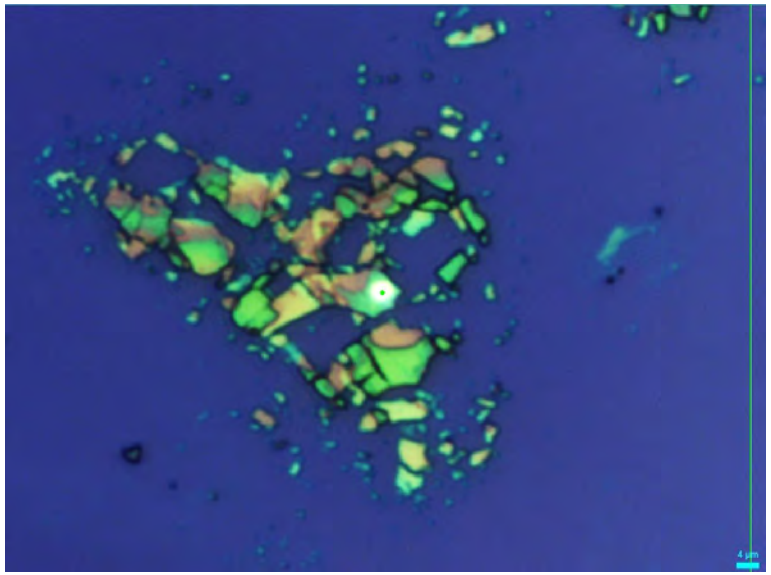




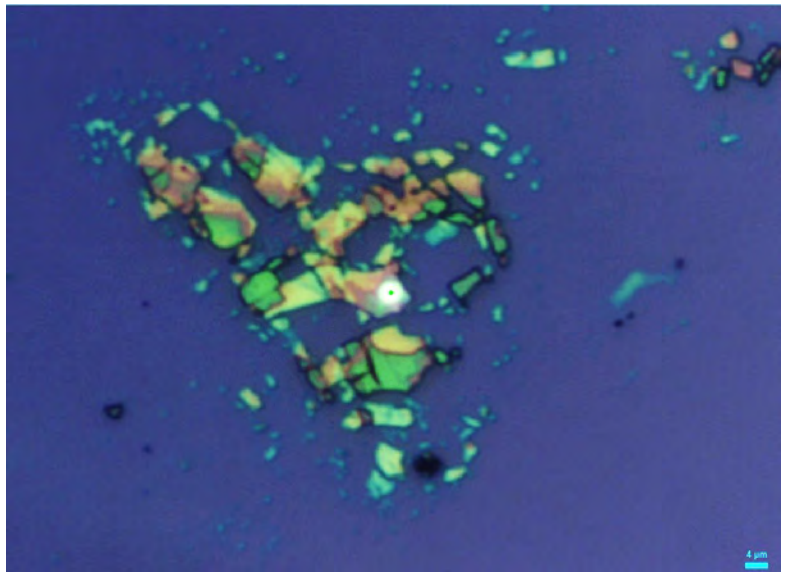


Unprotected Perovskite over Time

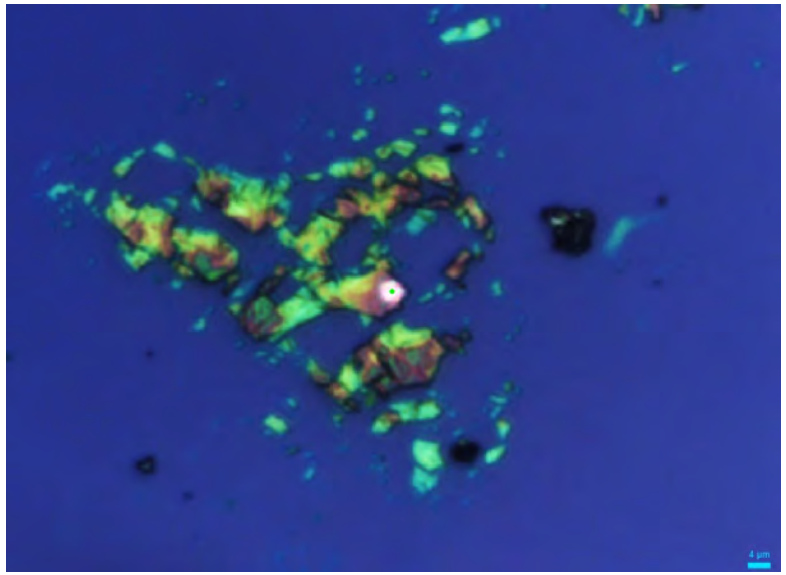
Problem: degradation in oxygen



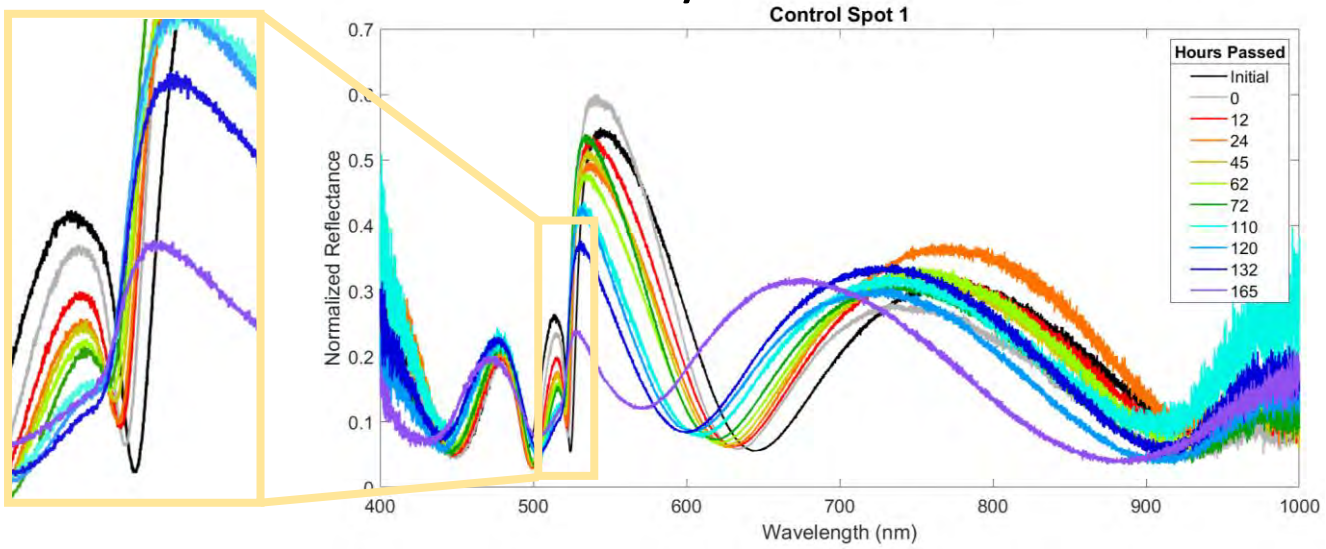
Fresh Perovskite



3 Days Later

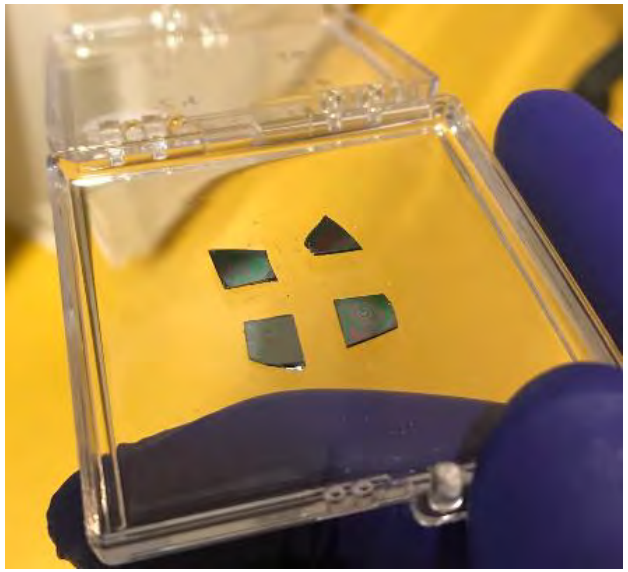


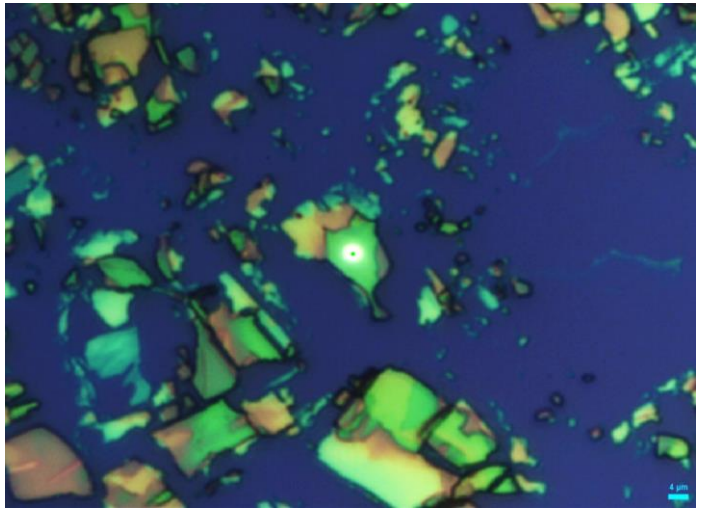
7 Days Later



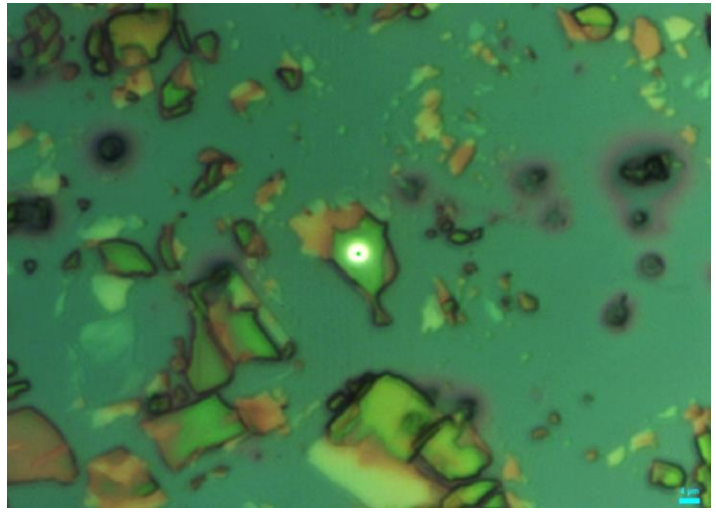
Approach: Polystyrene Coating

- Spin coating at various RPMs (revolutions per minute)

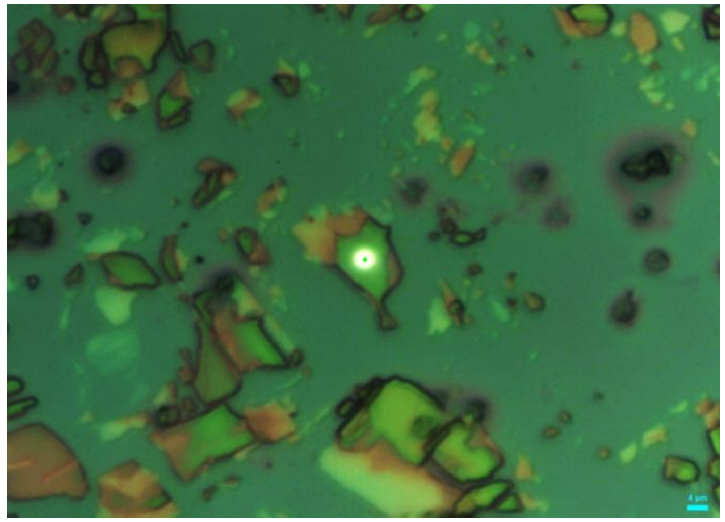




Fresh RP1



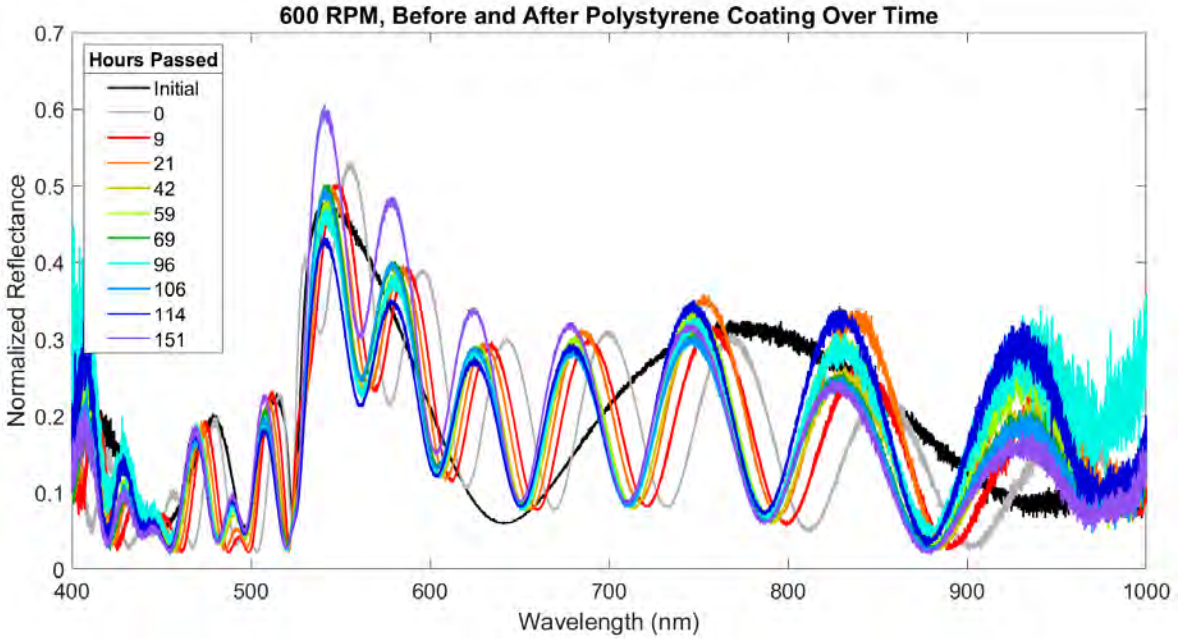
Directly after applying polystyrene coating

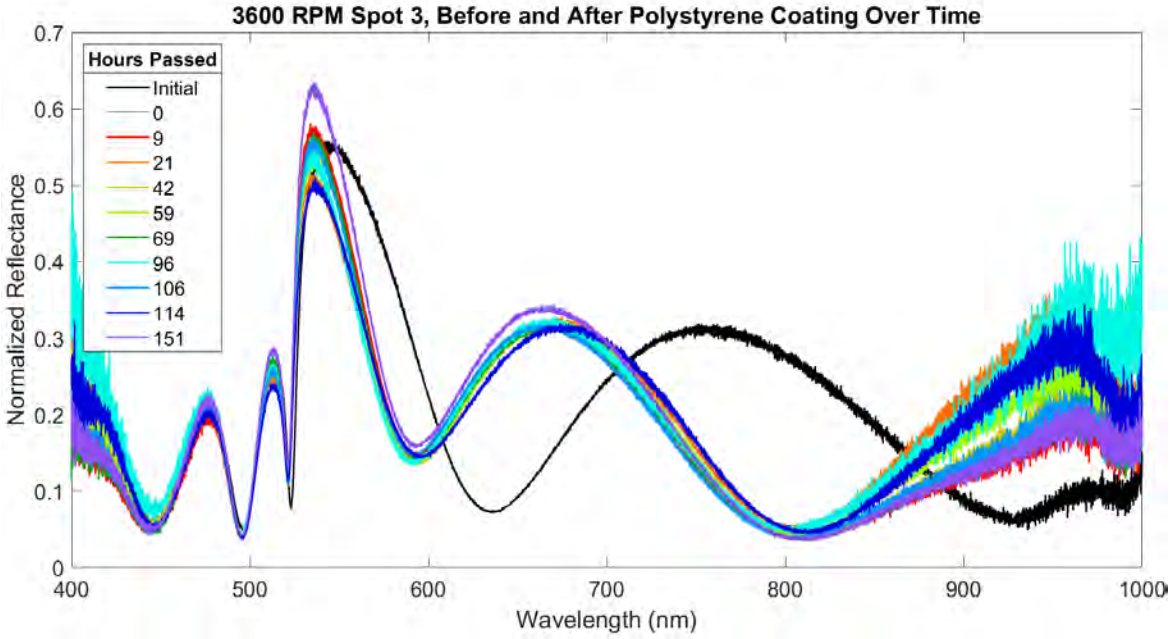


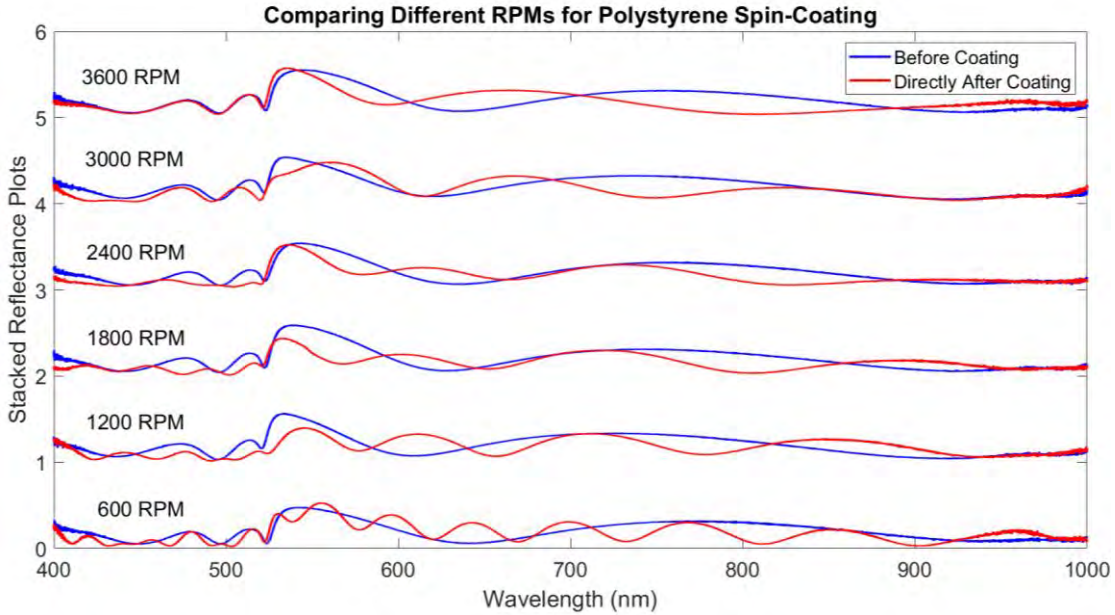
7 days later

(Left outside to be exposed to air between measurements)

Results: Varying Amounts of Change

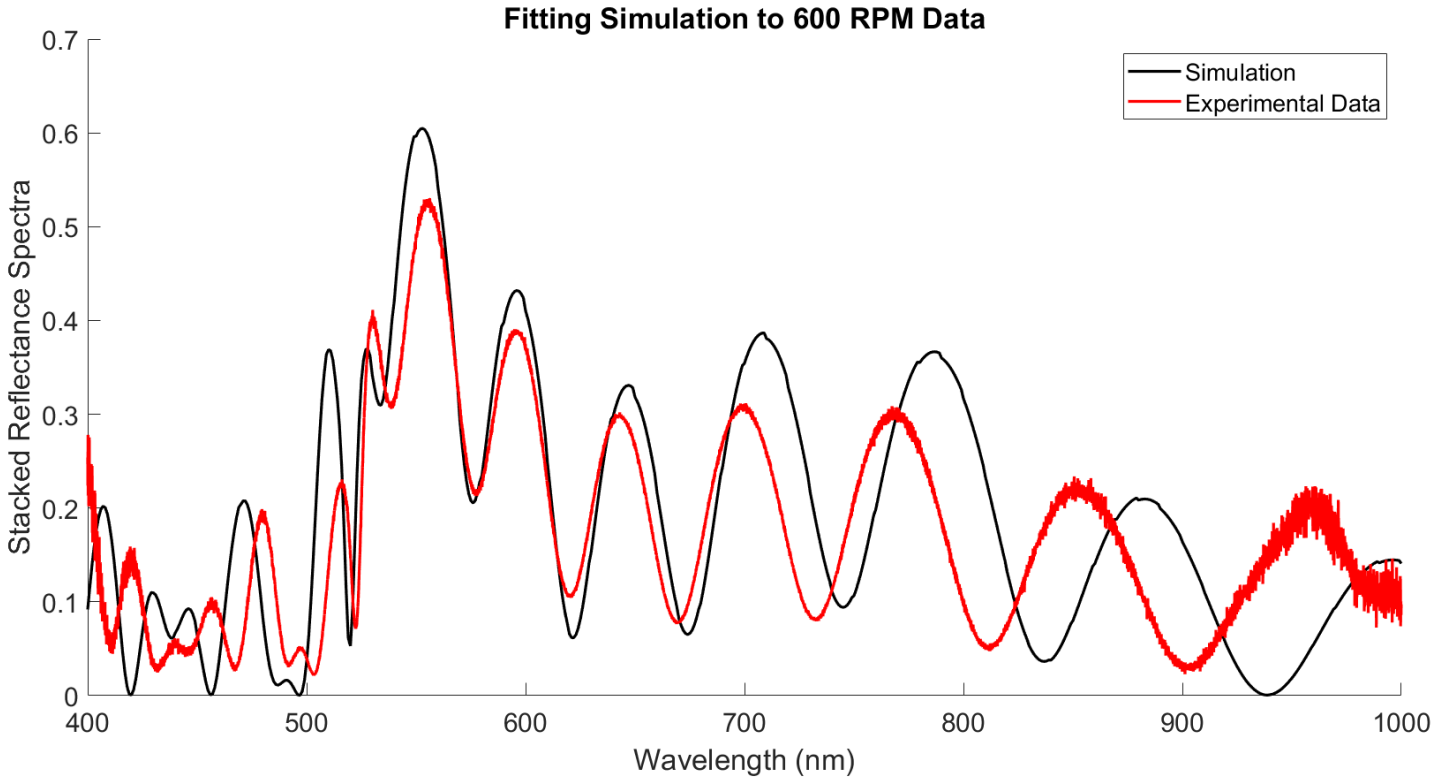


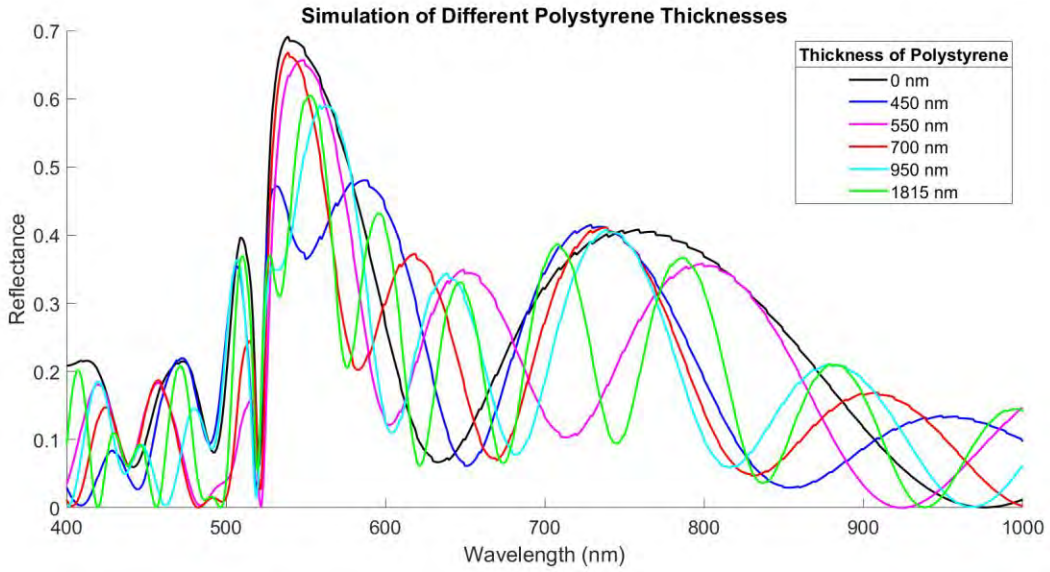


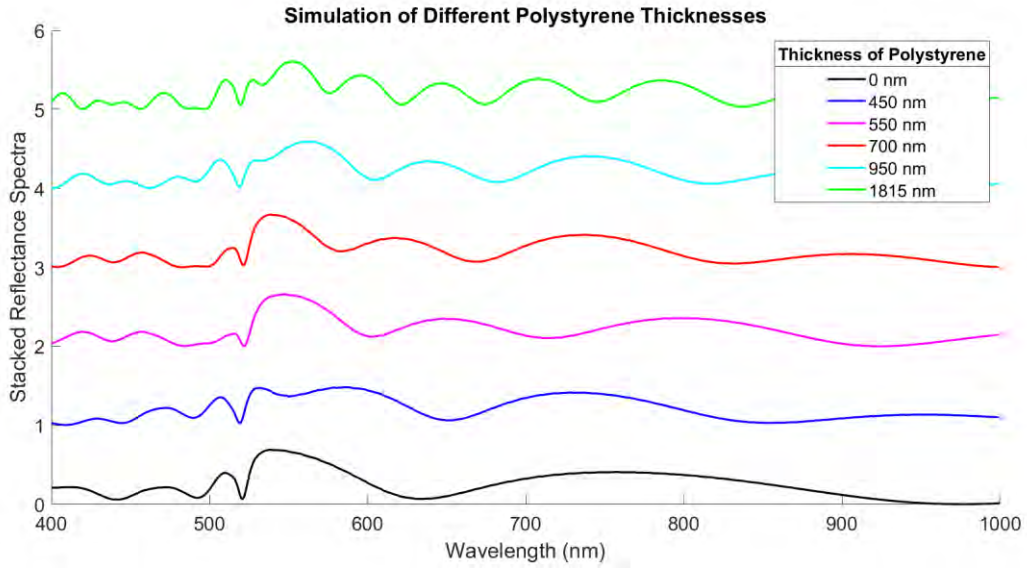


Simulation Analysis

RPM	Sim-Suggested Polystyrene Thickness (nm)
600	~1815
1200	~900 to 975
1800	~700
2400	~500 to 600
3000	~550
3600	~415 to 525



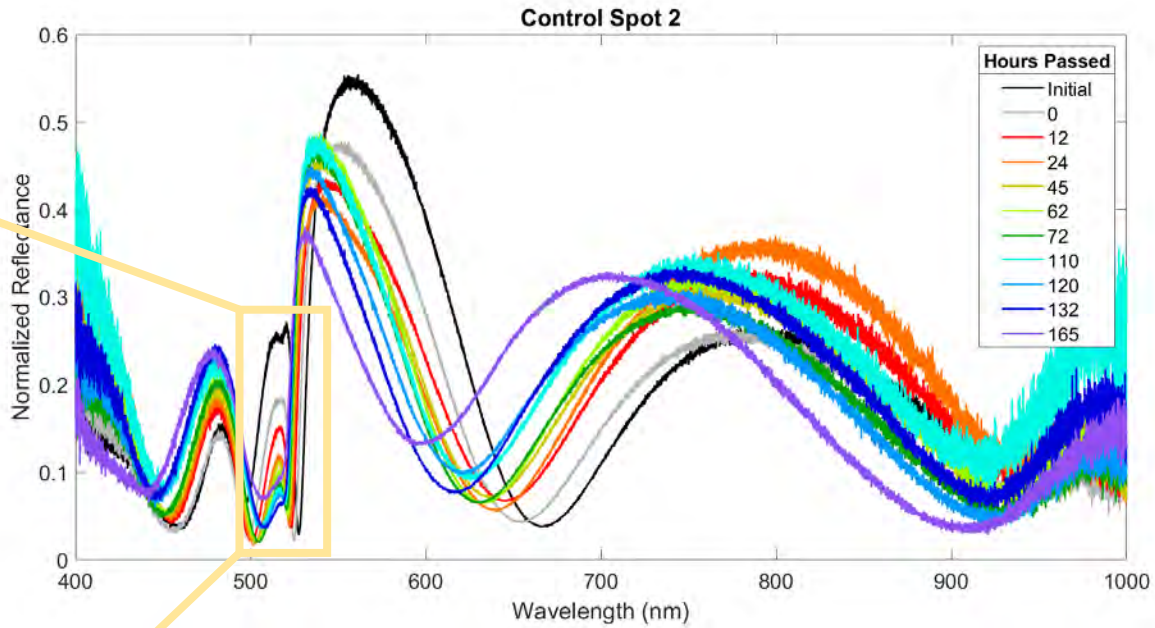


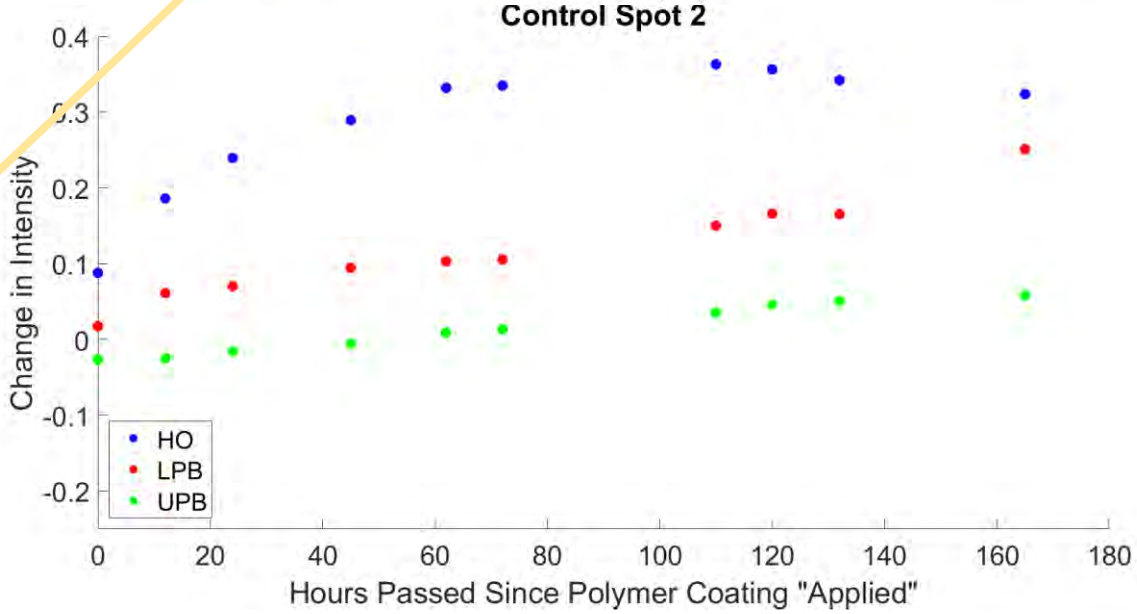


Change in Intensity of Unencapsulated RP1/300nm SiO_2/Si

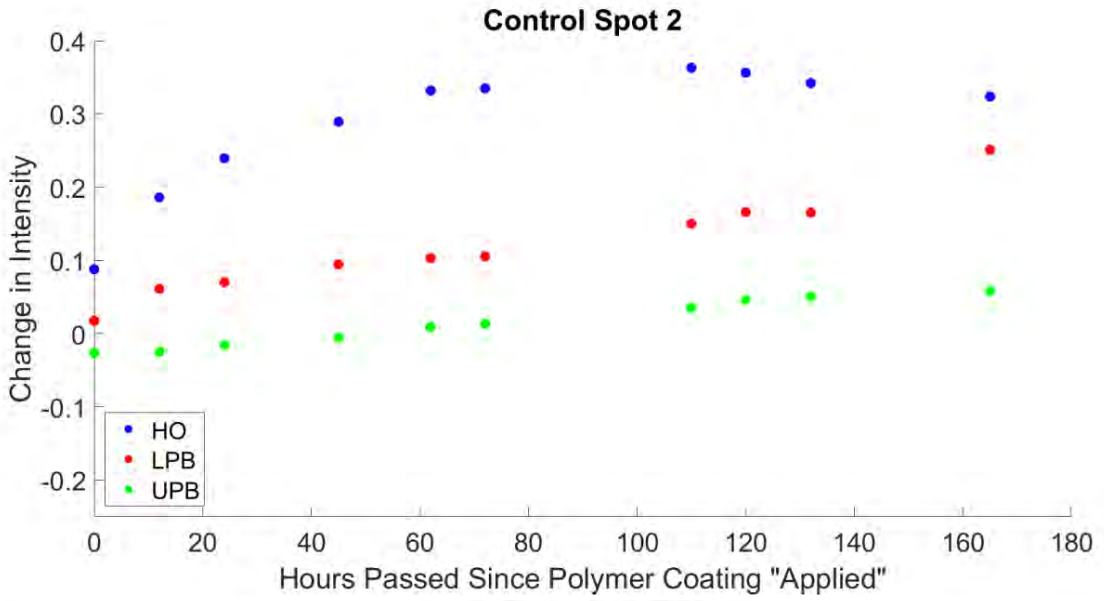
$For\ fixed\ Wavelength_{initial}:\ Intensity(t) - Intensity(initial)\ for\ t \geq 0,$

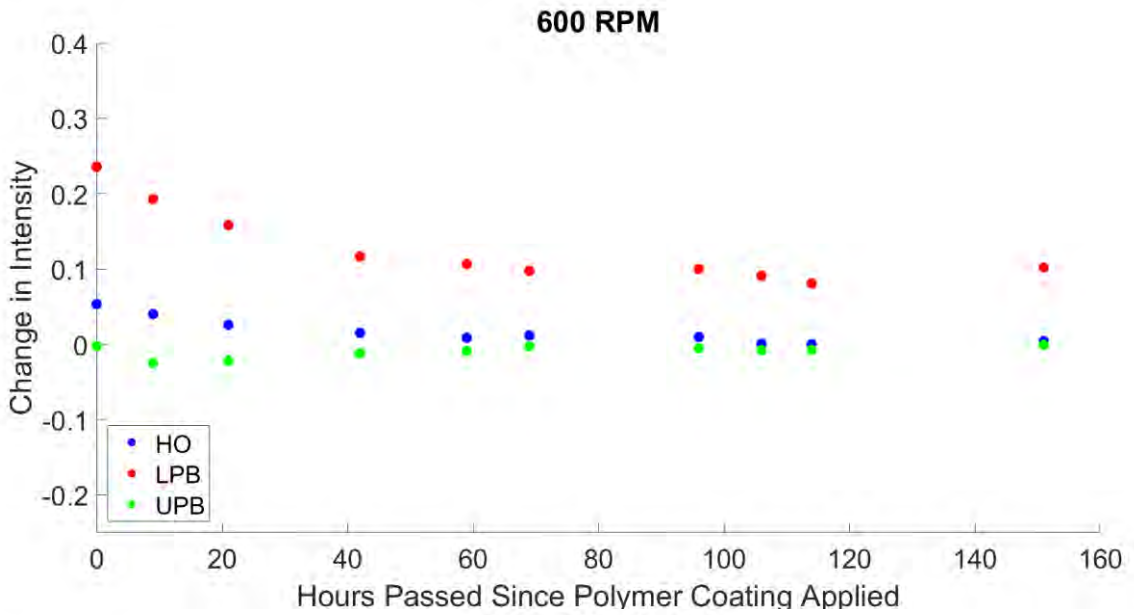
t being time since polystyrene coating applied.

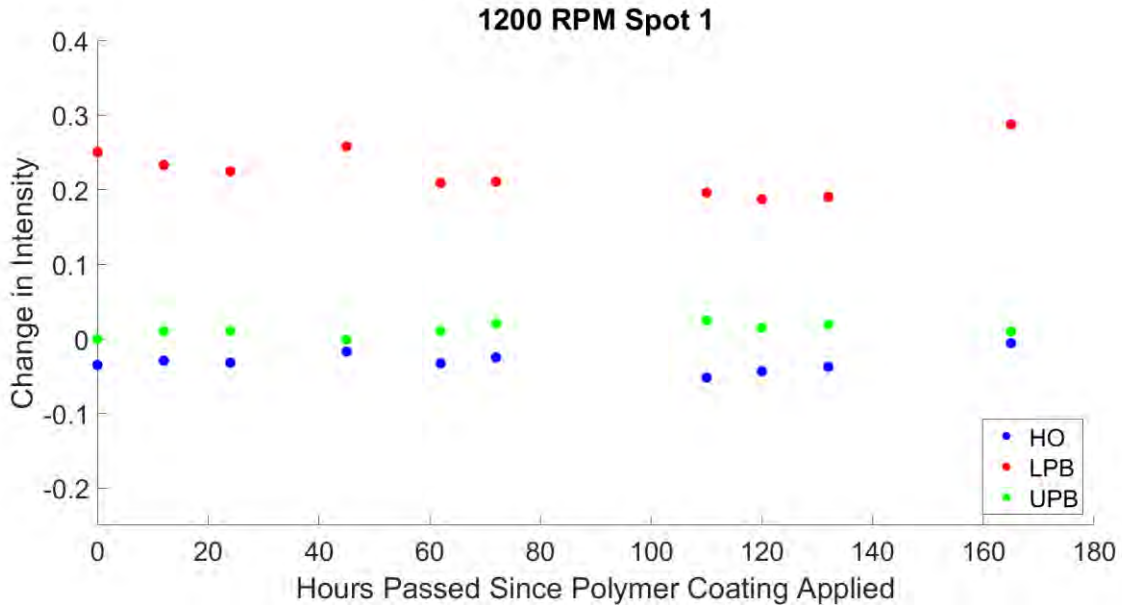


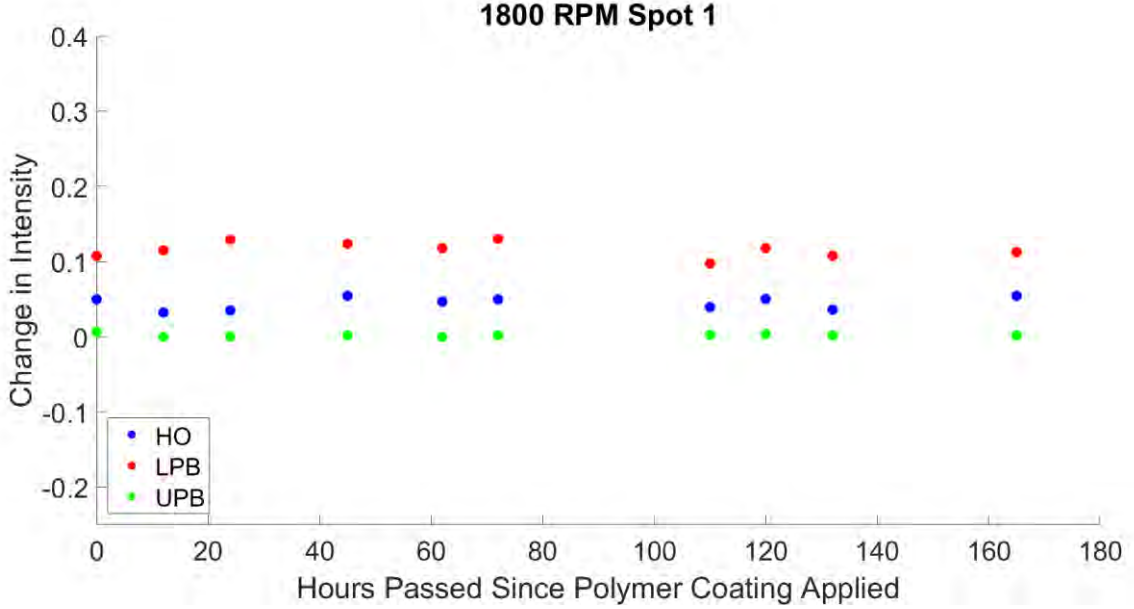


Comparison Between Control and Different RPMs

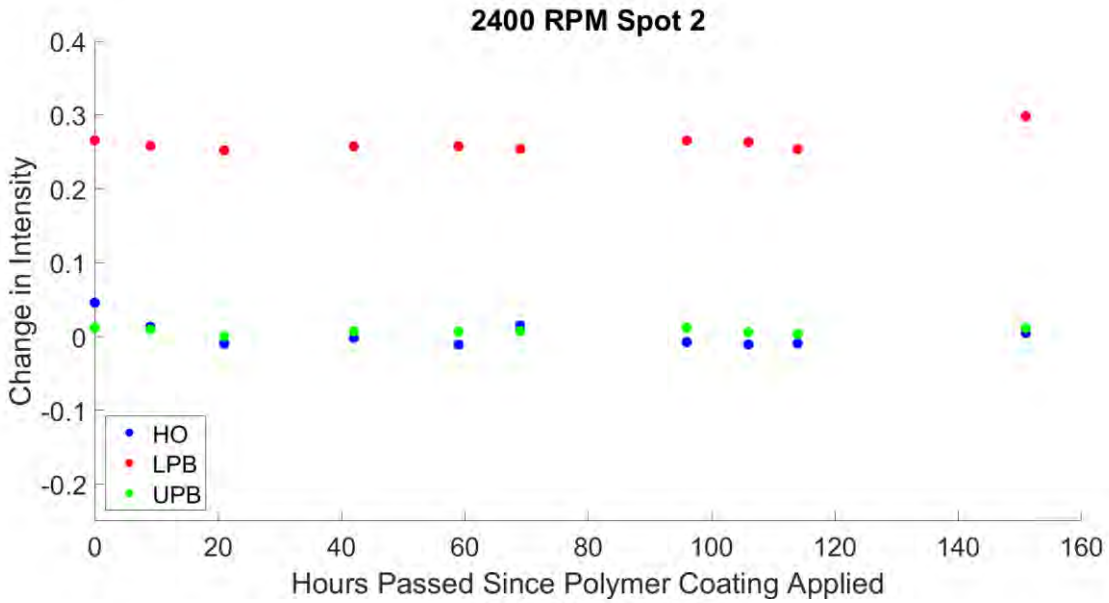


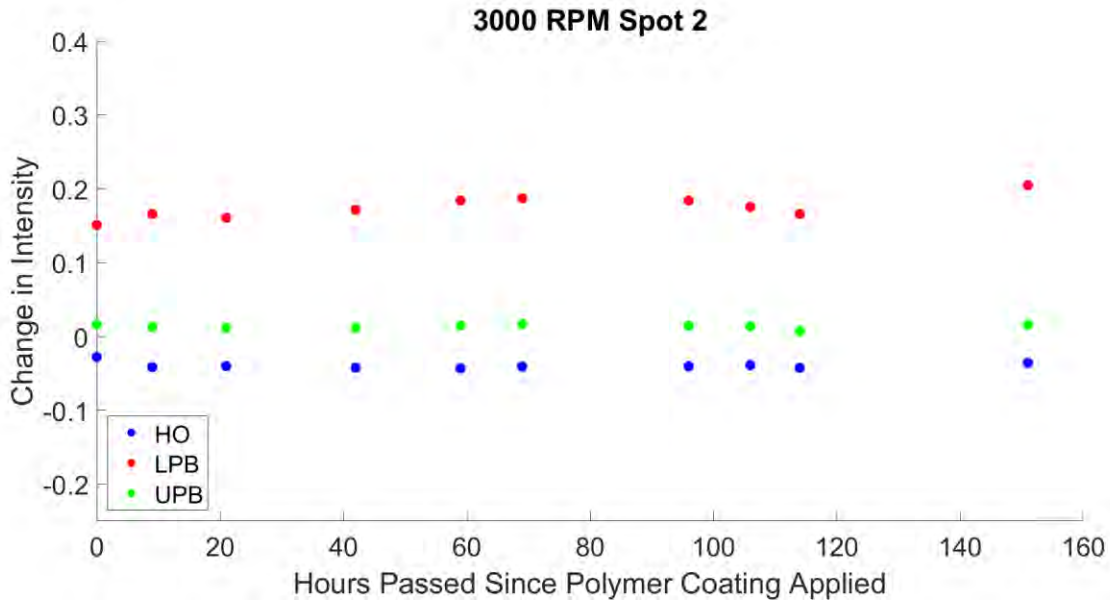


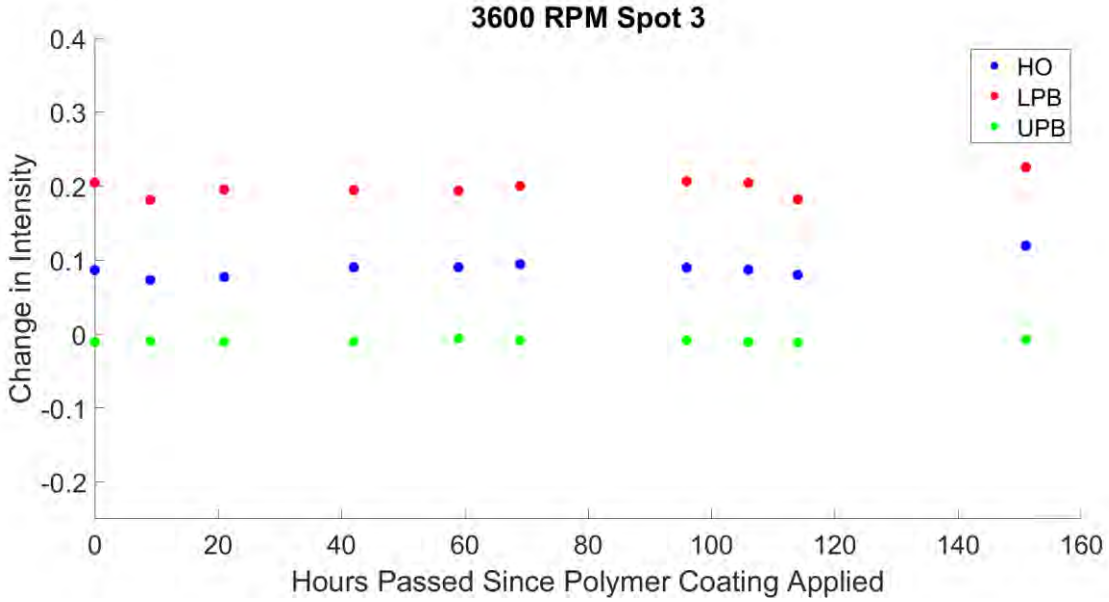




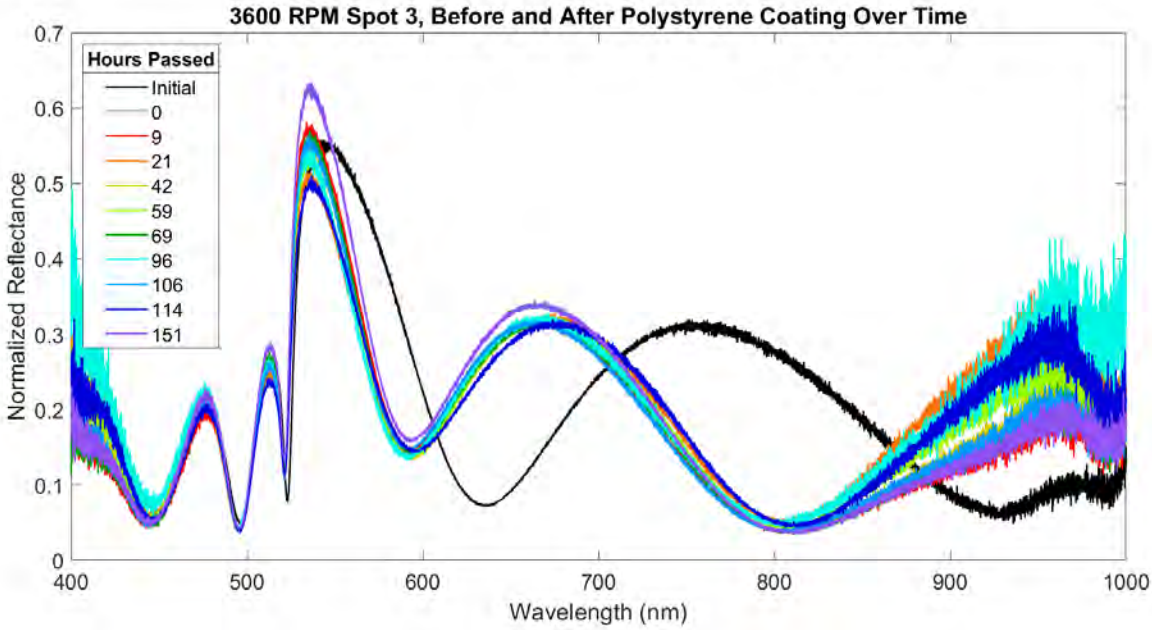
Comparison Between Control and Different RPMs Cont.

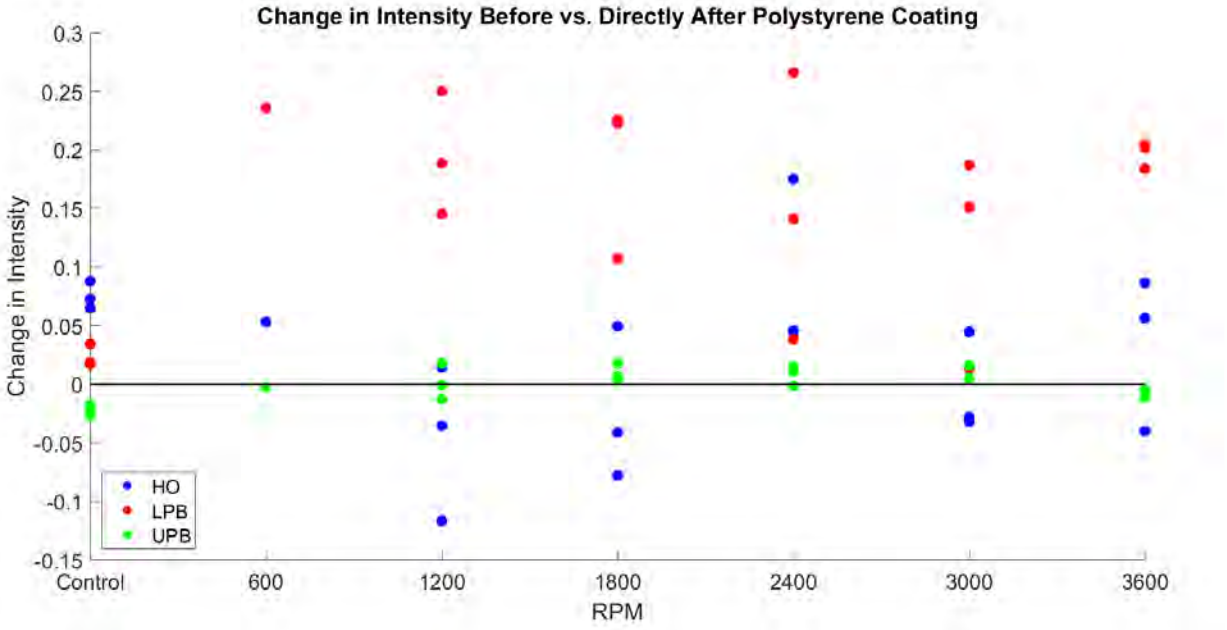




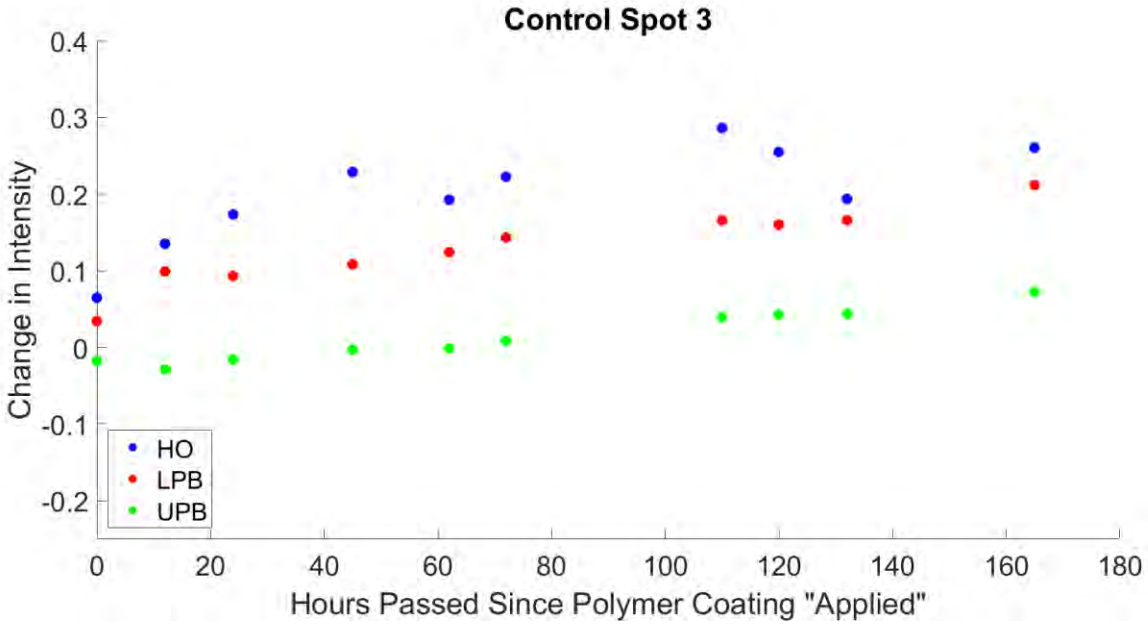


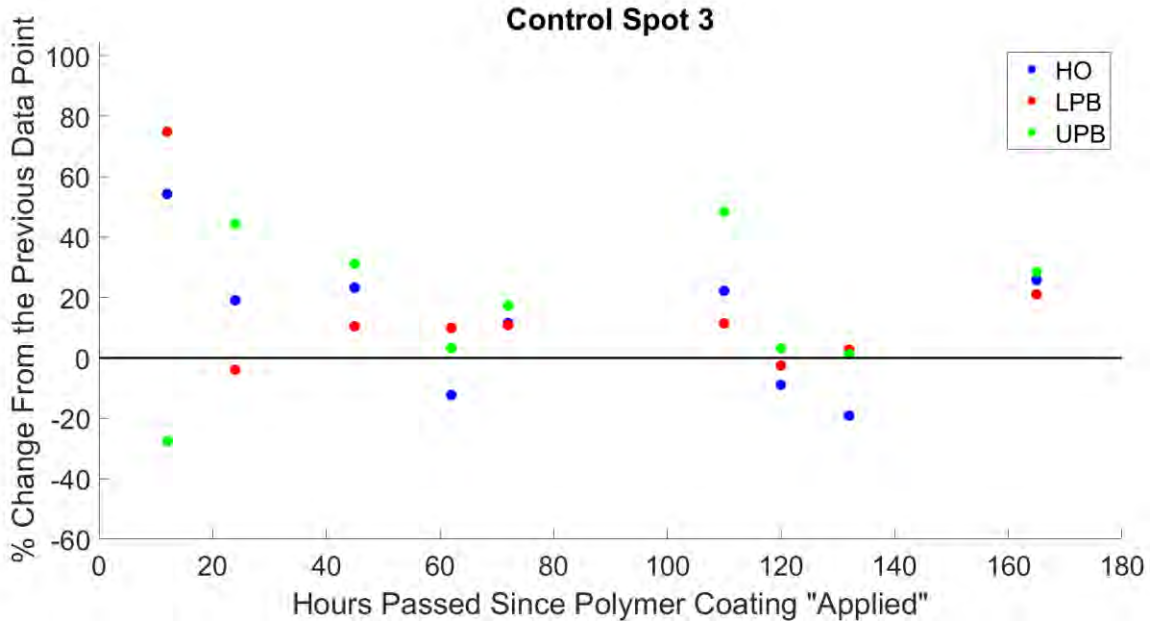
Additional Cavity Modes Upon Polymer Coating





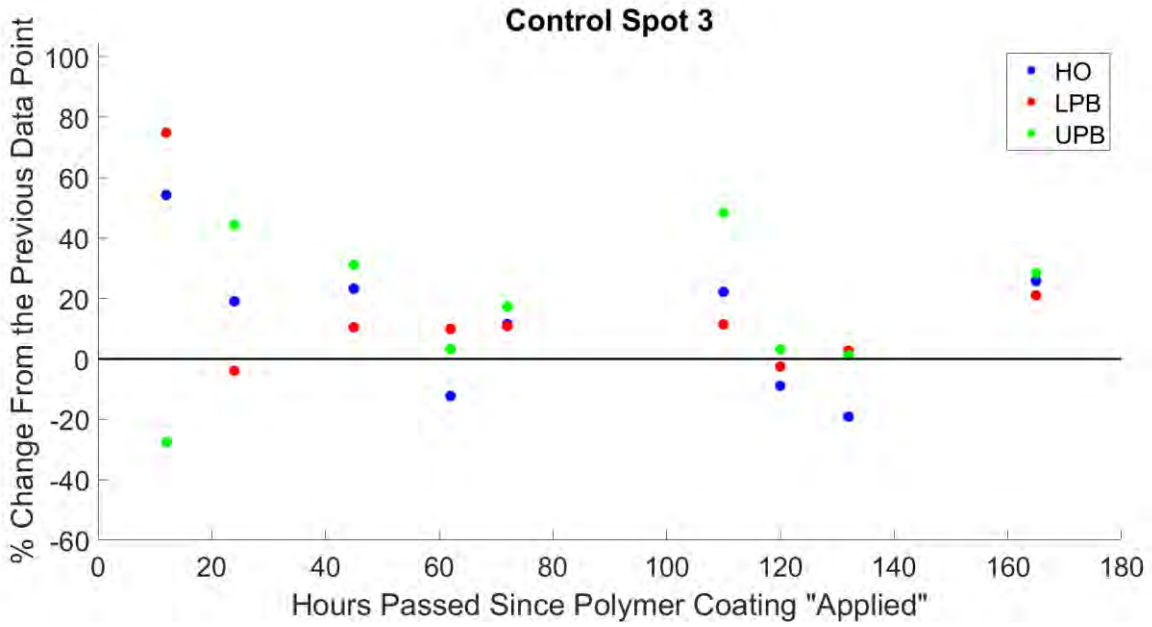
Now, Percent Change in Intensity of HO,UPB,LPB

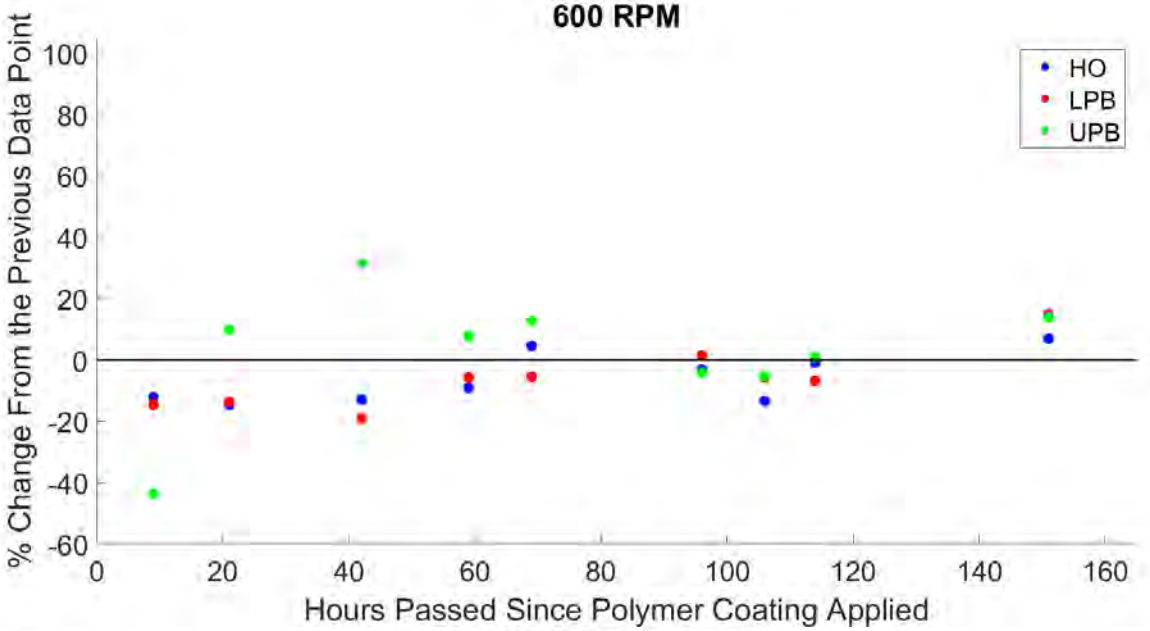


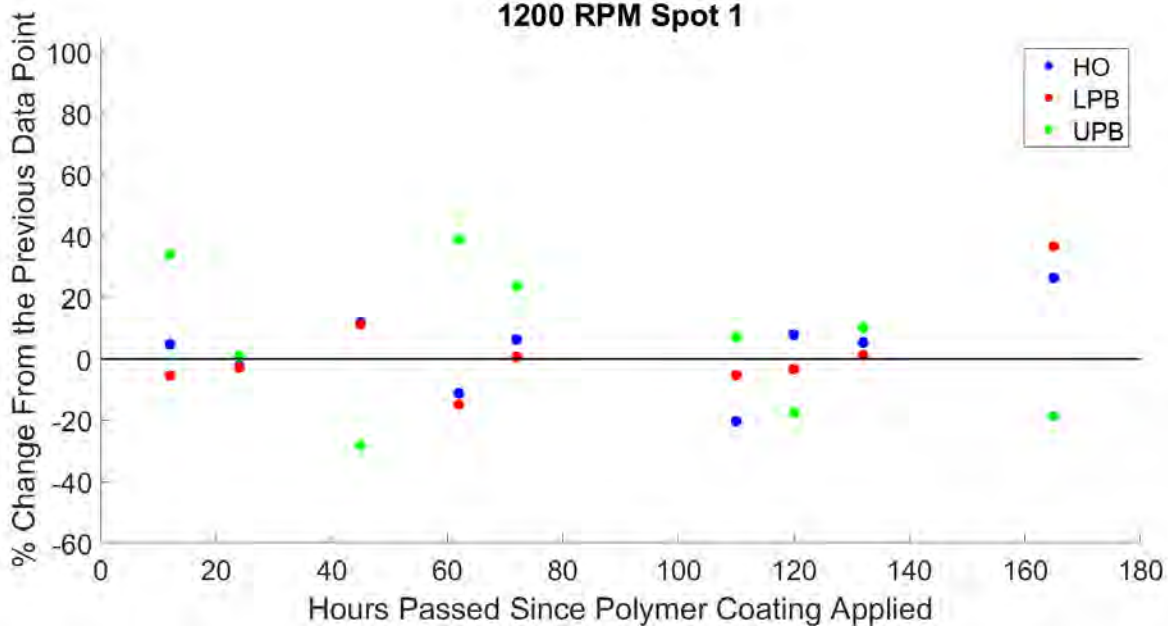


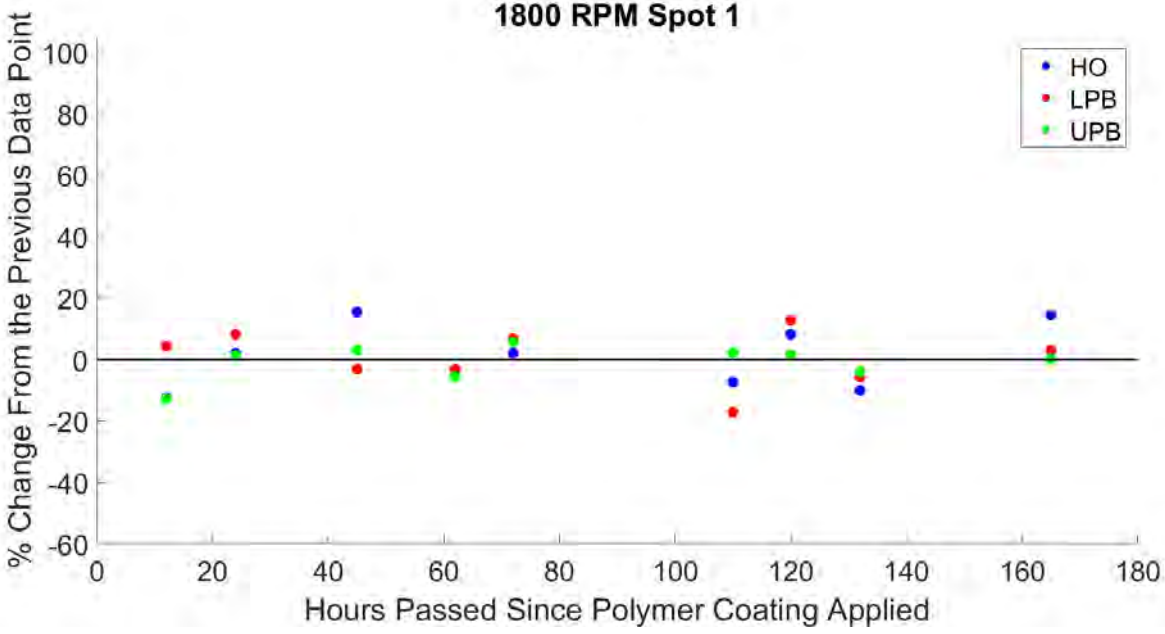
$$\frac{Intensity(t_n) - Intensity(t_{n-1})}{Intensity(t_{n-1})} \times 100$$

Comparison Between Control and Different RPMs

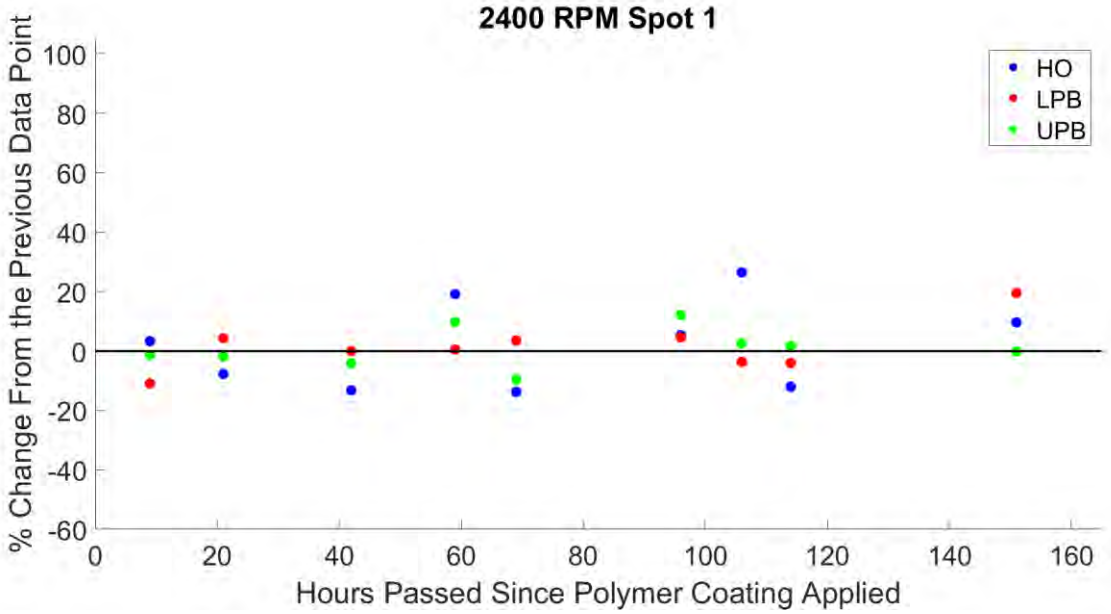


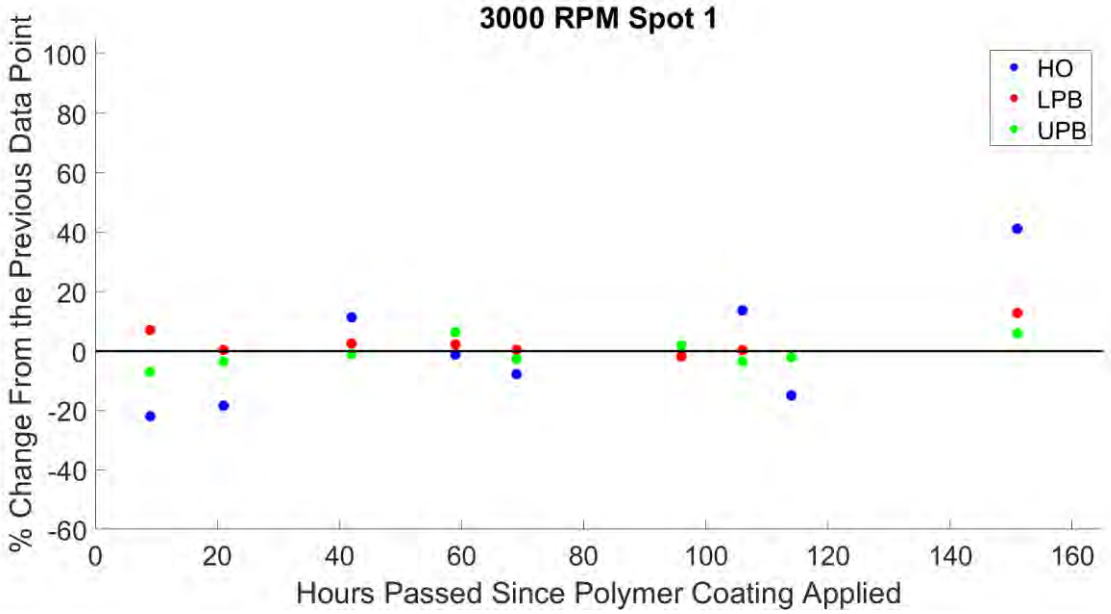


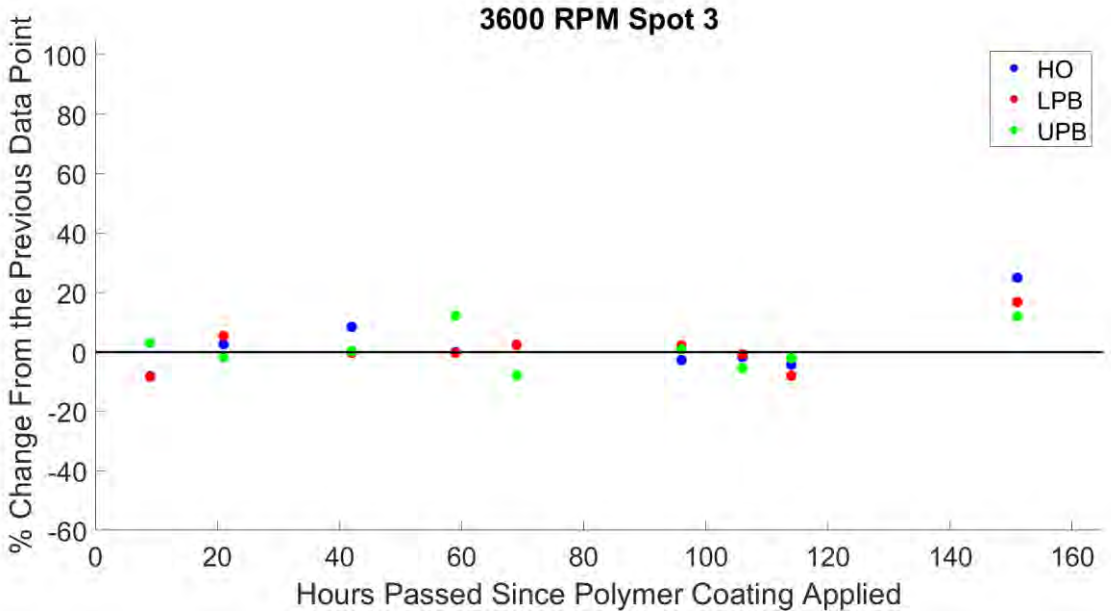




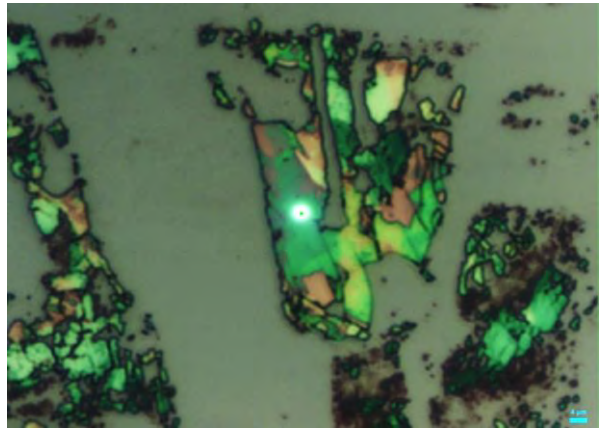
Comparison Between Control and Different RPMs Cont.



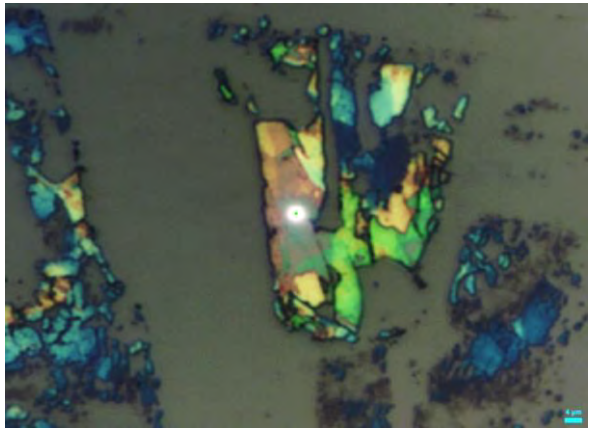




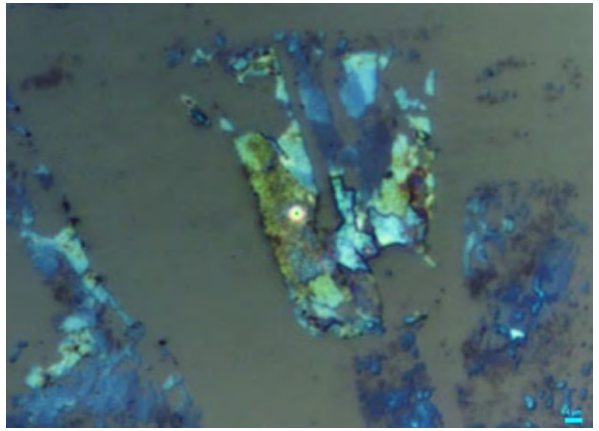
A Sample of PVD Al_2O_3 on RP1 Over Time



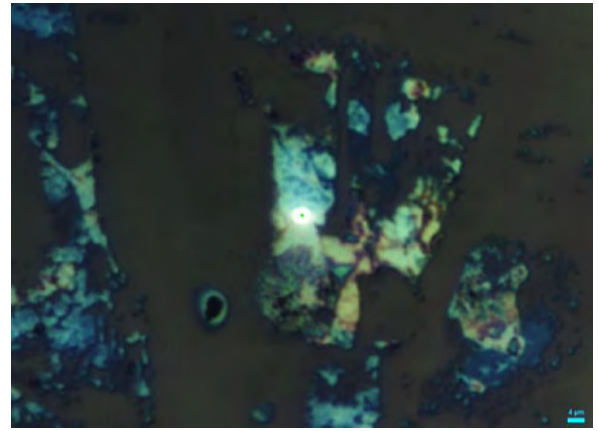
Fresh RP1



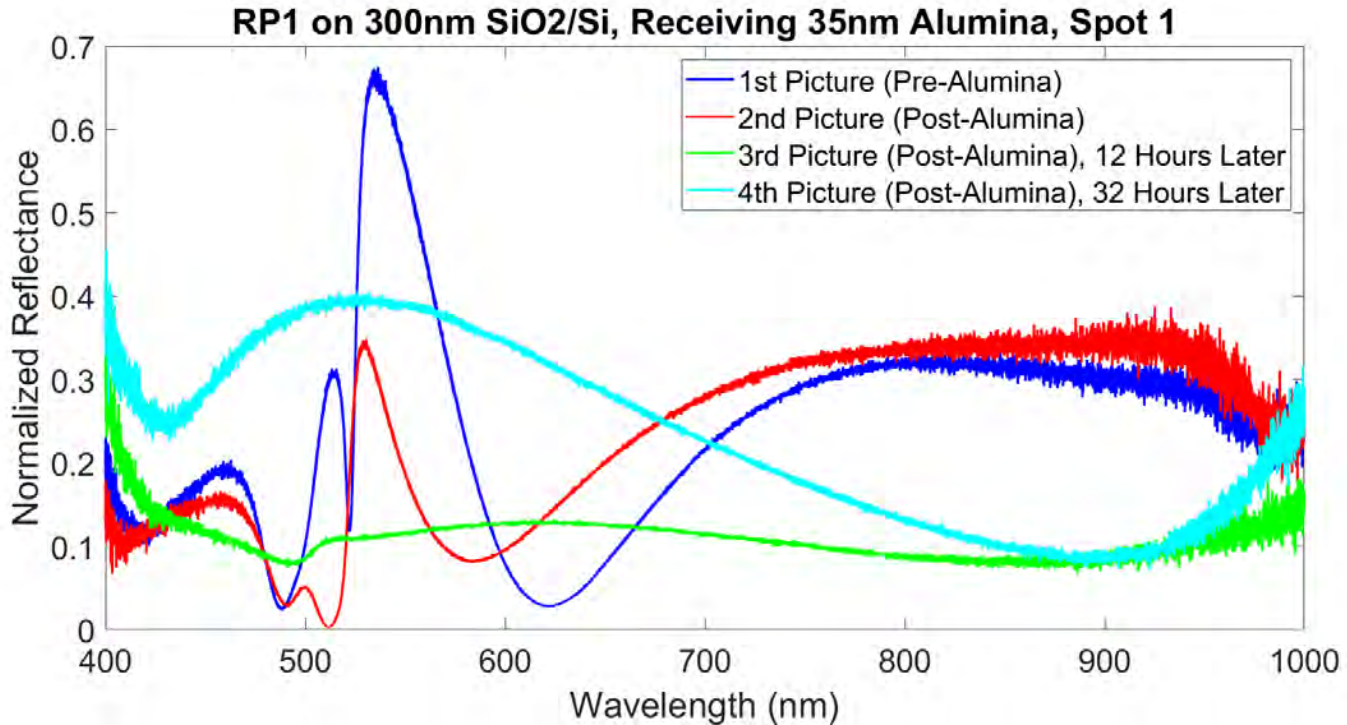
Within 2 hours of alumina deposition



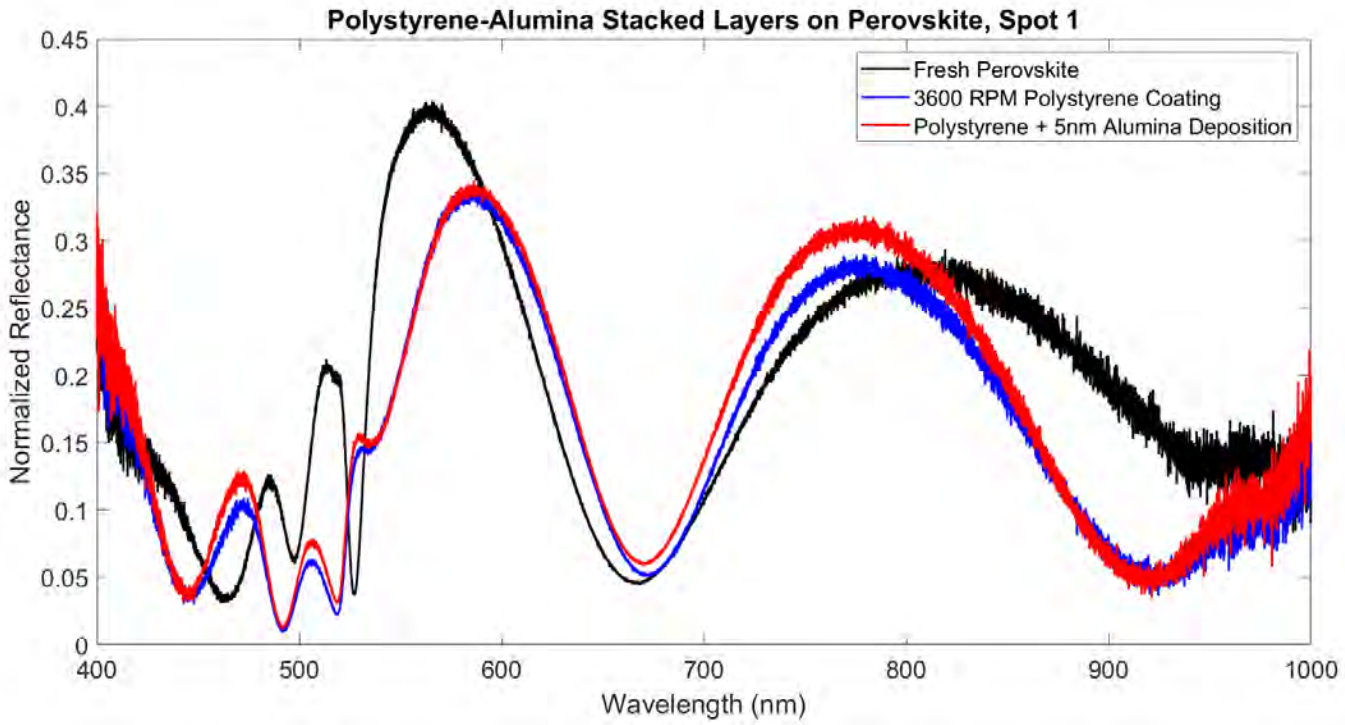
12 hours after deposition

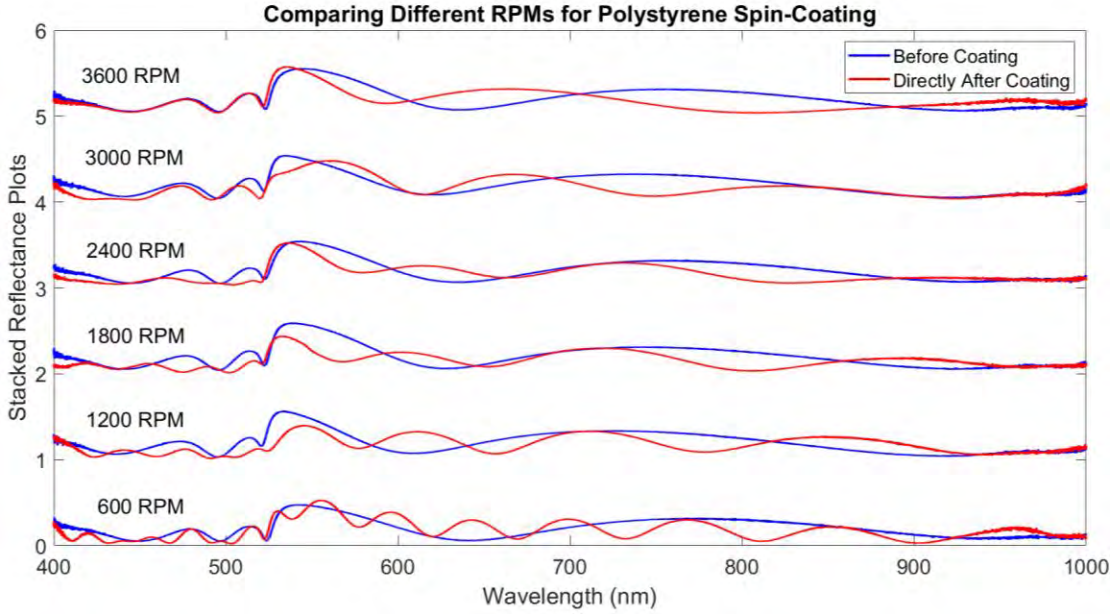


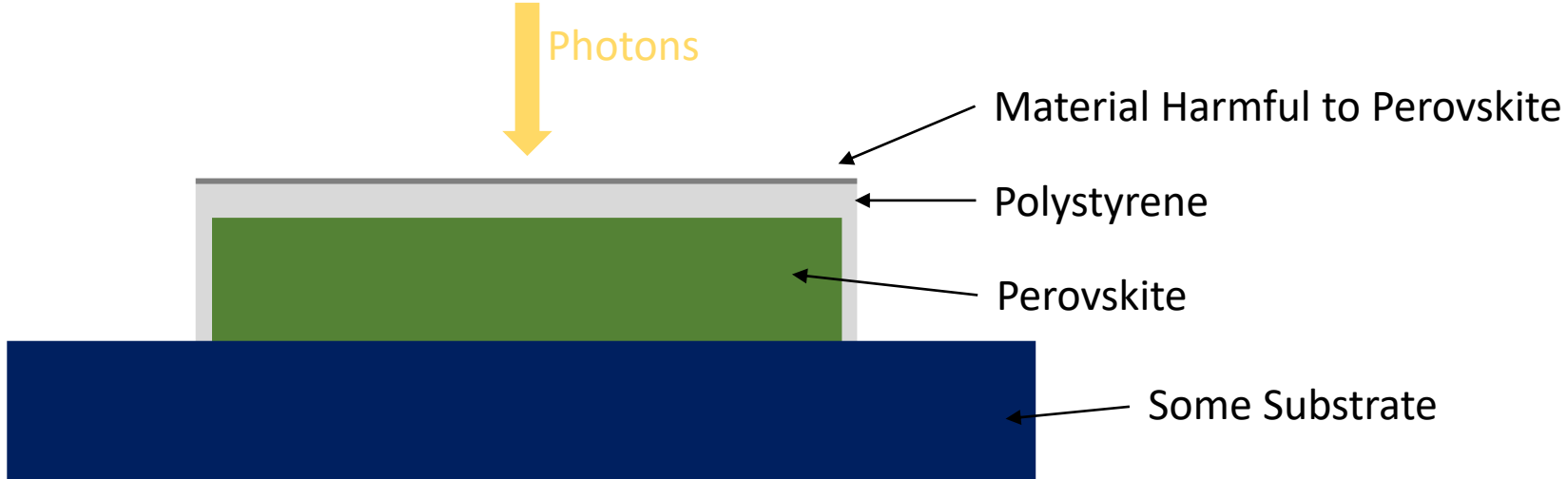
32 hours after deposition



Future Potential







Acknowledgements

- Mentor: Dr. Surendra Anantharaman
- PI: Dr. Deep Jariwala
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