Combinatorial spectroscopic ellipsometry and quartz crystal microbalance with dissipation to study organic ultra-thin film evolution

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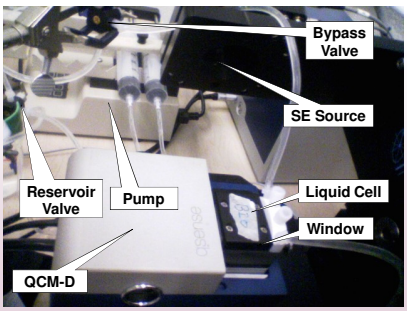
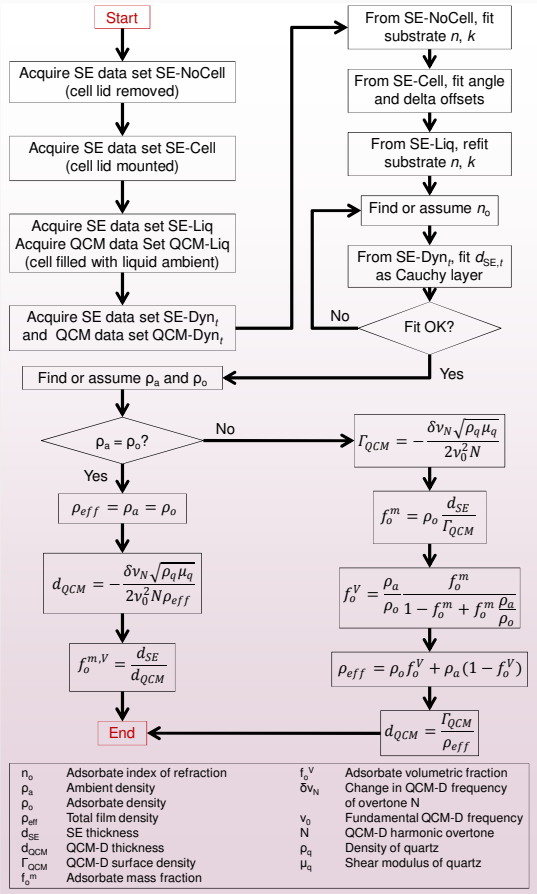
Our Message

- Ultra-thin (< 10 nm) organic thin film attachment was studied with combinatorial spectroscopic ellipsometry (SE) and quartz crystal microbalance with dissipation (QCM-D).
- The dynamic porosity of a self-assembled monolayer (SAM) was found, and the surface chemistry of the layer was verified by contact angle measurement.
- We report a preliminary study for biosensor applications where the chemisorption of molecular probes was monitored, *in-situ*, by SE/QCM-D. Selective hybridization of a target molecule to an aptamer probe was observed by SE.
- SE/QCM-D is a technique well suited for monitoring chemical adsorption or chemisorption and providing structural information through the porosity parameter.

Experimental Setup

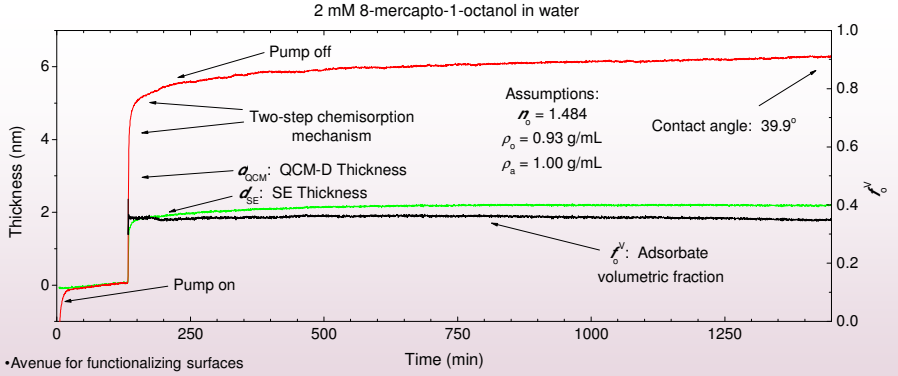


Measurement and Analysis Scheme

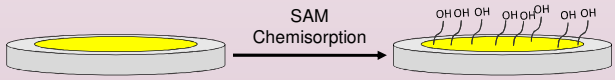


n_o	Adsorbate index of refraction	f_o^V	Adsorbate volumetric fraction
ρ_a	Ambient density	$\delta\nu_N$	Change in QCM-D frequency of overtone N
ρ_o	Adsorbate density	ν_0	Fundamental QCM-D frequency
ρ_{eff}	Total film density	N	QCM-D harmonic overtone
d_{SE}	SE thickness	ρ_q	Density of quartz
d_{QCM}	QCM-D thickness	μ_q	Shear modulus of quartz
Γ_{QCM}	QCM-D surface density		
f_o^m	Adsorbate mass fraction		

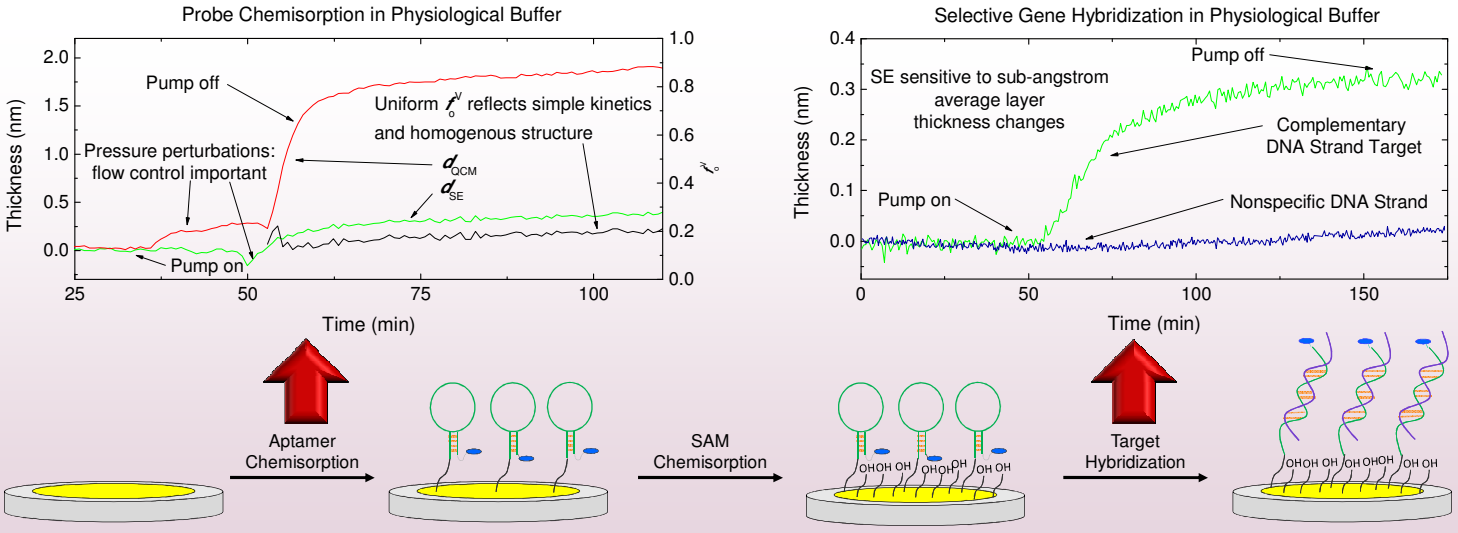
Self-Assembled Monolayer (SAM) Chemisorption



- Avenue for functionalizing surfaces
- Model biomaterial surfaces
- How do chemisorption kinetics and porosity change with time?



Selectively Detecting Genes that Increase the Risk of Prostate or Pancreatic Cancer



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