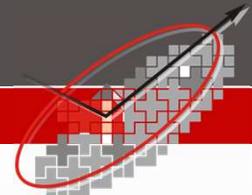




Monitoring Protein Adsorption on Self-Assembled Monolayers of Alkanethiols on Gold, *in-situ*, with Combined SE / QCM-D Techniques



UNIVERSITY OF NEBRASKA-LINCOLN

K. B. Rodenhausen^{1*}, B. A. Duensing¹, A. K. Pannier¹, S. L. Bartelt-Hunt², T. Hofmann¹, M. Schubert¹, T. E. Tiwald³, M. Solinsky⁴, and M. Wagner⁴

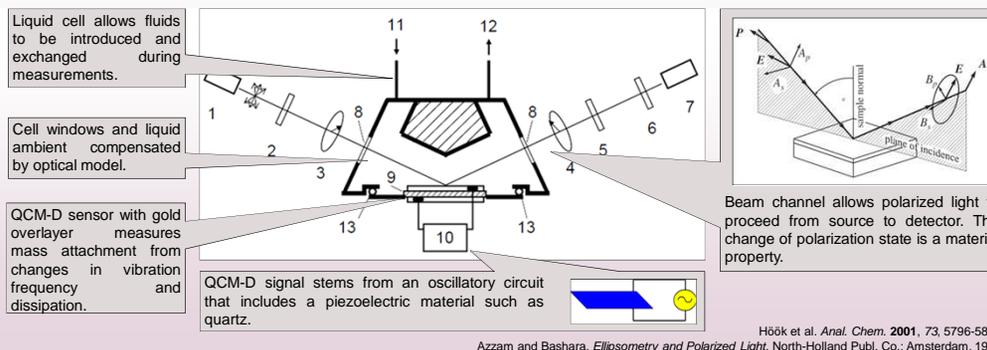
¹ University of Nebraska-Lincoln, U.S.A.; ² University of Nebraska-Omaha, U.S.A.; ³ J. A. Woollam Co., Inc., Lincoln, NE, U.S.A.; ⁴ The Procter & Gamble Company, Cincinnati, OH, U.S.A.;

ellipsometry.unl.edu
*kbrod@cox.net

Our Message

- We report that combined spectroscopic ellipsometry (SE) and quartz crystal microbalance with dissipation (QCM-D) methods can be used to differentiate adsorbed protein conformation.
- First, we introduce self-assembled monolayers (SAMs) of different alkanethiols to chemisorb to the QCM-D sensor.
- Then we introduce proteins (fibronectin or prions) in a PBS buffer to adsorb to the SAM of choice.
- We find that the mass porosity of the protein layer, due in part to the structure and conformation of the individual proteins, is related to the defined surface chemistries of the SAM systems. The combined SE / QCM-D technique could be a useful tool for differentiating protein conformations.

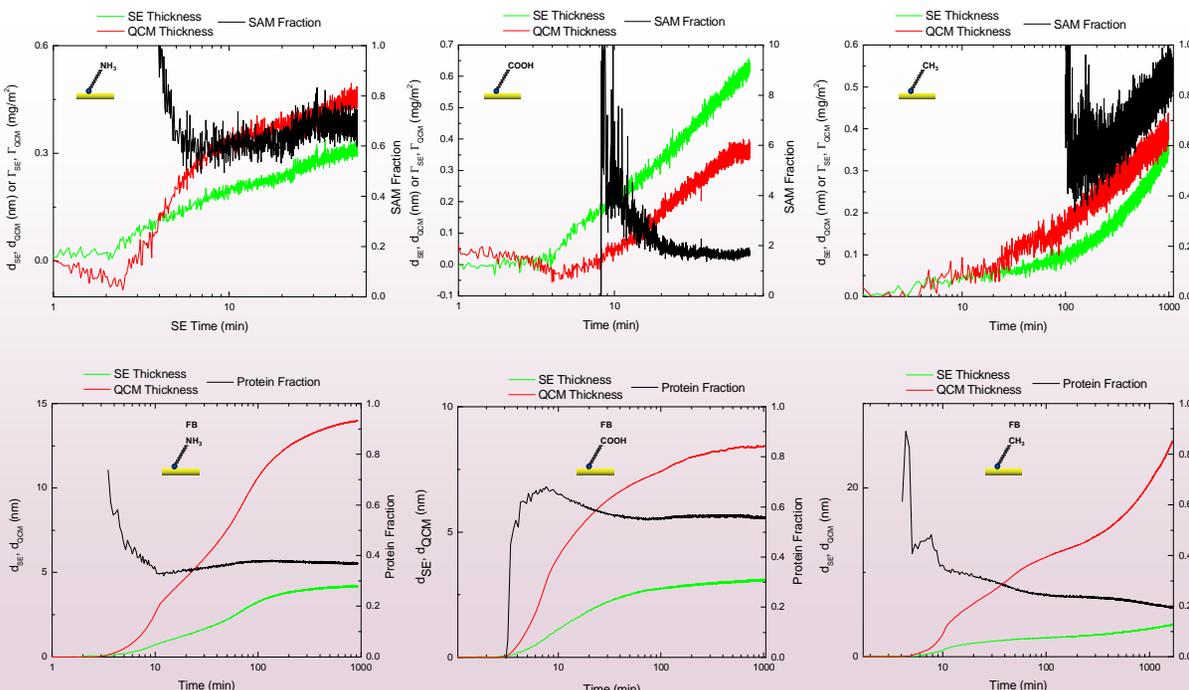
Instrumentation



Materials

- SAMs (bottom left) are alkanethiols with a functionalized group (COOH, NH₃, or CH₃) and are chemisorbed via ethanol solvent.
 - The thiol group chemisorbs with the substrate, allowing the SAM to impart the chemistry of the chosen functionalized group over the substrate.
 - Fibronectin (bottom center) or prion (bottom right) conformation (hydrophobic interior and hydrophilic exterior in polar solvent bulk) on the surface will depend on the SAM functionalized group
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- Rickford et al. *EMBO J.* 2001, 20, 1519-1529.
Donne et al. *Proc. Natl. Acad. Sci. USA* 1997, 94, 13452-13457.

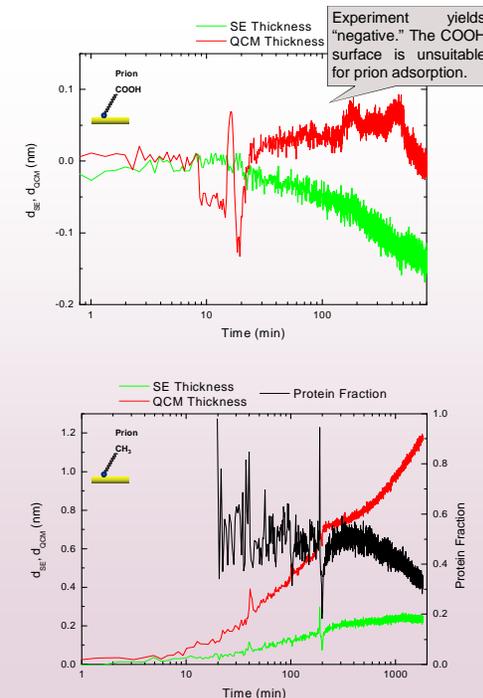
Results of SAM Chemisorption and Subsequent Fibronectin Adsorption



- The NH₃- and COOH-terminated SAM graphs reflect the current challenges of this work, instrumental drift and other bulk effects that affect the QCM-D results.
- A density of 1.00 g/mL was assumed for the SAMs, allowing direct conversion from thickness (nm) to surface density (mg/m²).
- For all optical measurements, the index of refraction for all wavelengths (*n*) was set to 1.5.

- Fibronectin adsorption onto charged hydrophilic surfaces (left and center) is markedly different than onto a neutral hydrophobic surface (right).
- A density of 1.37 g/mL was assumed for the protein layer.

Applications for Prion Research



Experiment yields "negative." The COOH surface is unsuitable for prion adsorption.