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Integrated in-situ Techniques for Studying Protein Adsorption Behavior on Polymer Thin Films

The ongoing challenge of preventing disease transmission underscores the need for materials that reduce pathogen adhesion and proliferation. Medical devices such as catheters and implants are prone to biofilm formation, which is often initiated by protein adsorption. While much is known about protein adsorption on rigid surfaces, significant gaps remain regarding polymer surfaces, where flexibility and mobility add complexity. Traditional models fail to explain our lab's findings, particularly for protein adsorption on neutral polymers. Previous ex-situ data from our group shows that adsorption is positively correlated on film thickness independent of polymer chemistry [1]. Additionally, polymer thin films show strong antifouling behavior for thicknesses under 20 nm. Here, we present new insights into protein adsorption mechanisms on polystyrene (PS) thin films. Films were made at different thicknesses from the flattened layer (2-3 nm) up to 100 nm. We present new in-situ experiments to further elucidate the interactions that drive protein adsorption on polymer surfaces using bovine serum albumin (BSA) and human plasma fibrinogen as model protein. We combine neutron reflectivity (NR), quartz crystal microbalance (QCM), sum frequency generation (SFG), and atomic force microscopy (AFM) techniques to study adsorption kinetics, protein/polymer binding, protein orientation, and protein penetration at the polymer interface.

1. Salatto D. et al. Macromolecules 2020 53 (15), 6547-6554.

Topical Area

Soft matter: polymers, and complex fluids

Authors: GAUER, Aiden; DOUGHTY, Benjamin; WANG, Hanyu; COLLINS, Liam; BLAKE, Marea; ZIMIC, Marko (Stony Brook University); ENDOH, Maya (Stony Brook University); RETTERER, Scott (CNMS); KOGA, Tad (Stony Brook University)

Presenter: GAUER, Aiden