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Chemistry Materials Colloquium

Thursday, March 10, 2022 4:30 PM WTHR 104

"Proteins at Interfaces"

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Abstract:

We are identifying molecular scale material properties that stabilize or shut down bio-macromolecular function in abiotic environments. The influence of materials on protein folding and function impacts to a wide range of applications, from drug delivery to ship paints. To address this issue, we are collaborating with Martin Gruebele to pioneer new approaches to quantify protein folding stability in situ. This talk will focus on recent studies of protein interactions with zwitterionic polymers, alginate and temperature responsive poly(N-isopropyl acrylamide) (pNIPAM). Fluorescence measurements of polymer/protein interactions produced surprising results that challenged widespread views of protein compatibility and protein resistance. For example, despite a common view that poly zwitterions such as poly(sulfobetaine) (pSB) are 'super low fouling', our results showed that pSB binds and destabilizes proteins in solution. These results have important implications for the design of protein resistant surface coatings. In recent work with Gruebele (Chemistry, U of Illinois), we are pioneering a new fluorescence based approach to visualize the impact of polymer micro environments on protein folding stability in situ, at submicron spatial resolution and millisecond time resolution. Our recent studies revealed how crowding and polymer chemistries cooperate to alter the stability of immobilized or encapsulated proteins. Results revealed unexpected ways that polymers perturb proteins and open up new avenues for identifying material properties that preserve or shut down protein function.