

Interactions between peptides and inorganic matter: From basic science to applications

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Several natural processes are mediated by the interactions between organic and inorganic materials. The immune response towards an implant inserted into the body is mediated by proteins. Composite materials are formed by the interactions of organic materials (usually proteins) and minerals. Biofouling, the process in which organisms attached to surfaces, is also mediated by organic molecules. Understanding the nature of interactions between organic and inorganic materials will bring to the development of improved implants, new composites and antifouling materials.

This lecture will present single-molecule force spectroscopy measurements of the interactions between individual biomolecules (either amino acid residues or short peptides) and inorganic surfaces in aqueous solution. Using this method, we were able to measure low adhesion forces and could clearly determine the strength of interactions between individual amino acid residues and inorganic substrates. Our results with peptides also shed light on the factors that control the interactions at the organic-inorganic interface.

Based on our knowledge from single molecule experiments, we designed a short peptide (tripeptide) that can spontaneously form a coating that resists biofilm formation. Our results clearly demonstrate the formation of a coating on various surfaces (glass, titanium, silicon oxide, metals and polymers). In addition, we showed that this coating prevents the first step of antifouling, which involves the adsorption of bioorganic molecules to the substrate. Moreover, the coating significantly reduces the attachment of various organisms such as bacteria and fungi to surfaces.

References:

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