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הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar
Monday, Oct 16th, 2023 at 13:30
Room 1
https://technion.zoom.us/j/94829843688

Preparation, mechanics and particle deposition behavior of thin, low-fouling hydrogel coatings

Lina Rozental

PhD Seminar

Advisor: Asst. Prof. Viatcheslav Freger
Department of Chemical Engineering, Technion-Israel Institute for Technology
Co-advisor: Prof. Charles Diesendruck
Department of Chemistry, Technion-Israel Institute for Technology

Hydrogels, soft materials that consist of crosslinked hydrophilic polymers, are known for unique properties like biocompatibility, biodegradability, flexibility and fouling resistance. These properties render hydrogels suitable for a variety of applications, including antifouling coatings. Submicron-thin hydrogel coatings can be particularly useful in screening a substrate from fouling while maintaining its original function. However, the preparation of stable and firmly anchored thin hydrogels is challenging and the role of properties like swelling and elastic modulus on their fouling propensity remains elusive. The goal of this work was to prepare representative thin hydrogel coatings and to study their adhesive and micromechanical properties. The results were compared to the macroscopic deposition of colloidal particles on the gels, a process resembling the initial stages of fouling.
To this end, two types of hydrogel coatings based on known low-fouling materials were prepared and covalently anchored to presilanized glass as a model substrate. The first type of coating was prepared from amine- and epoxy-terminated 4-arm-PEG precursors, with varying amine-epoxide ratios. The second type was prepared by copolymerization of zwitterionic SPE with varying amounts of glycidyl methacrylate (GMA). In both cases, the crosslinking and surface anchoring steps occurred simultaneously.
The hydrogels were characterized by AFM force spectroscopy. In both types of gels, the swelling ratio and elastic modulus were only weakly affected by the crosslinker content. In the PEG-based gels, adhesion was not affected by salinity, but strongly affected by the contact time between the probe and the gel (dwell time) as well as by pH. In contrast, in particle deposition experiments, which were performed with polystyrene particles identical to the AFM probe, both salinity and pH strongly affected deposition. In the polyzwitterionic gels, remarkably low adhesion was observed in gels with the lowest GMA content. The results highlight the possibilities and limitations of tailoring hydrogel properties and underscore the importance of adjusting antifouling coatings to the environmental conditions for optimal fouling resistance.

Refreshments will be served at 13:15