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Role of Monomer Sequence, Hydrogen Bonding and Mesoscale Architecture in Marine Antifouling Coatings

RACHEL SEGALMAN, UC Santa Barbara

Polypeptoids are non-natural, sequence specific polymers that offer the opportunity to probe the effect of monomer sequence, chirality, and chain shape on self-assembly and surface properties. Additionally, polypeptoid synthesis is more scaleable than traditional polypeptides suggesting their utility in large area applications. We have designed efficient marine anti-fouling coatings by using triblock copolymer scaffolds to which polypeptoids are tethered in order to tune both the modulus and surface energies with great precision. Surprisingly, when short sequences are tethered to a polymer backbone, polypeptoids consistently outperform analogous polypeptides in antifouling properties. We hypothesize that the hydrogen bonding inherent to the polypeptide backbone drives the observed differences in performance. We also find that the polymer scaffold housing the polypeptoids also plays a crucial role in directing surface presentation and therefore the overall coating properties.