Protein nanopatterning on self-assembled diblock copolymer templates

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Abstract

The ability to control the position of proteins on a nanoscopic scale is crucial in many biomedical and bioengineering applications. We demonstrate here a simple, novel and versatile method for the nanopatterning of proteins on the surface of polymer thin films. Immiscible diblock copolymers are self-assembled into highly ordered morphologies with domain sizes on the nano-scale. In our work, self-assembled polystyrene-block-polyisoprene (PS-*b*-PI) thin films with various structures of spheres, cylinders and lamellae were successfully controlled by adjusting the diblock ratio, film thickness and heat treatment conditions. The copolymer thus creates a spatially and chemically heterogeneous template that permits the nano-scale control of bovine serum albumin (BSA, a model protein) by domain-selective adsorption. It was found through a combination of atomic force microscopy and time-of-flight secondary ion mass spectrometry that there is preferential adsorption of the BSA on PS rather than on PI surfaces. The well-ordered, nano-scale PS-*b*-PI templates can be exploited as a tool to easily and rapidly pattern the protein.