Anti-Fouling of Silicon Nanopore Membranes using SLIPS

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Background:

Silicon Nanopore Membranes (SNM) have been developed for application in an implantable bioartificial kidney. However, SNM are subject to fouling and thrombosis with continuous blood exposure. Thin polymer coatings have been applied to SNM as a strategy to limit cell adhesion and protein adsorption. Slippery Liquid Infused Porous Surface (SLIPS) is a bioinspired "omniphobic" surface coating that has been reported to prevent thrombosis and fouling on arteriovenous shunts. Here we present the application of SLIPS coating to SNM and evaluate protein adsorption in vitro.

Methods:

SNM with ~10 nm pores were coated with SLIPS and incubated with BSA-FITC (2 mg/ml in PBS) for 24 hours at 37°C. Uncoated (bare) silicon substrates served as controls. Fluorescence microscopy and ellipsometry were used to evaluate the surfaces and water transport through the SNM was tested using established hydraulic permeability assays.

Results:

SLIPS strongly reduced BSA-FITC adsorption on SNM compared to bare silicon. Ellipsometry confirmed the presence of SLIPS coating with a thickness of 0.5±0.2nm, which is theoretically thin enough to keep open the pores open in the membrane. However, hydraulic permeability testing revealed no ultrafiltration through the SNM for at least 24 hours and transmembrane pressures of up to 5 psi.

Conclusions:

SLIPS is a promising and easy-to-apply protein repellent coating, but it's highly omniphobic characteristic prevents ultrafiltration even through pores that are over 5x the coating thickness. For use in the bioartificial kidney, SLIPS has relevant.