

Synthesis of Poly(Propylene Sulfide)-Block-Poly(Ethylene Glycol), (Pps-Peg), and its Application to Surfaces

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INTRODUCTION: Poly(ethylene glycol) (PEG) has been used in numerous biomedical systems to reduce protein adsorption and cell adhesion. PEG can be attached to surfaces through a variety of different approaches including silanization, self-assembly of thiols, and plasma polymerization. In our approach series of block copolymers containing one (di-block) or two (tri-block) PEG chains separated by a poly(propylene sulfide) (PPS) part were used. Adsorbed to gold surfaces, a stable linkage between the sulfur atoms of the PPS thioether and the metal surface was observed. The hydrophilic PEG part forms a dense layer of biocompatible PEG chains, which is exposed to the aqueous environment.

METHODS: Various architectures of di- and tri-block PPS-PEG copolymers were synthesized², characterized, and adsorbed on gold substrates from methanol based solutions. While the PPS part was kept constant (goal: MW 4000), the PEG part was varied between 1100 and 5000 Da molecular weight. Adsorption of the polymer to the gold surface was characterized by *ex situ* ellipsometry, X-ray photoelectron spectroscopy (XPS), and *in situ* surface plasmon resonance (SPR). SPR was used to determine the resistance of the PPS-PEG adlayer upon human serum albumin (HSA) as well as full serum exposure.

50nm gold adlayers were deposited on glass substrates by using reactive magnetron sputtering techniques (PSI, Villigen, Switzerland) with an adhesive layer of 5nm Cr in between. SPR chips were purchased by Ssens (Hengelo, Netherlands)

The polymers were dissolved in methanol (1mg/ml) at room temperature and the substrates were dipped for 45 min and subsequently rinsed in pure methanol and dried with nitrogen. Protein resistance was tested with human serum albumin (1mg/ml in Hepes II) and full human serum. Uncoated substrates served as controls.

RESULTS: Both XPS intensities normalised to gold and *ex situ* ellipsometry thickness

measurements are in good agreement and show the chemisorption of PPS-PEG on gold.

Fig. 1 shows an SPR plot of polymer adsorption and subsequent HSA and serum exposure.

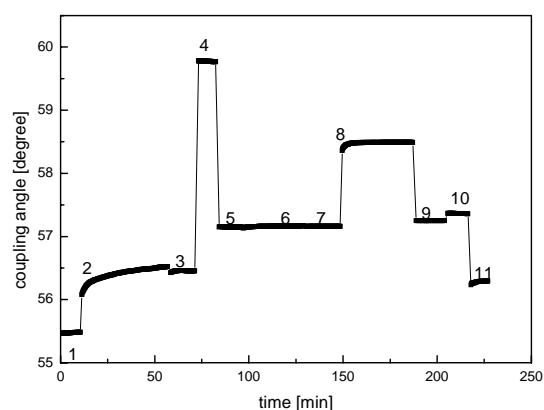


Fig.1: PPS-PEG Triblock (5000/2101/5000 Da) adsorbed on gold shows good resistance to HSA and serum. 1) Methanol baseline 2) PPS-PEG adsorption 3) Methanol rinse 4) change to ethanol 5) Hepes II baseline 6) Exposure to HSA 7) rinse with Hepes II 8) Exposure to serum 9) Hepes II rinse 10) Cleaner 11) Methanol.

DISCUSSION & CONCLUSIONS: PPS-PEG chemisorbs from methanol on gold surfaces. By variation of the PPS-PEG architecture it was possible to tailor the degree against protein adsorption of the surfaces till a maximum of 90% reduction upon serum exposure.

REFERENCES: ¹ J. P. Bearinger et al (2003) Nature Materials 2:259-264

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