

## Implant Infection (Antifouling and Antimicrobial Surface Coatings through Poly(2-methyl-2-oxazoline),)

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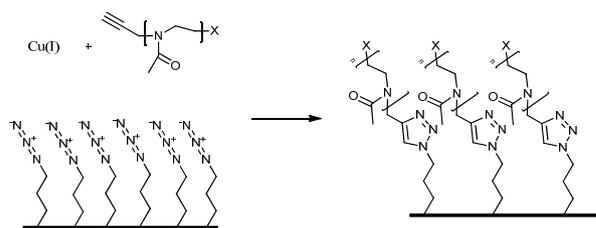
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**INTRODUCTION:** Bacterial infection of implanted materials and devices is a major health care problem causing an adverse impact on the quality of life of patients and high costs. Numerous studies have been conducted to generate thin coatings that reduce bacterial adhesion on solid substrates. Particularly, coatings based on polymers play a significant role in the design and creation of antifouling and antimicrobial surfaces. Some coatings attempt to overcome the issue of biofouling by incorporating the active moiety into a biopassive background, providing the surface with both biopassive and bioactive activities. Herein we report the design of dual functional surfaces by combining nonadhesive properties of poly(2-methyl-2-oxazoline) (PMOXA) with an antibiotic moiety to kill bacteria adhering onto the surface. The nonadhesive properties of PMOXA modified surfaces have been investigated and shown to be as efficient as poly(ethylene glycol) based surfaces in suppressing the adhesion of proteins and bacteria.

**METHODS:** In our approach bioinert surfaces of PMOXA were prepared via Cu-catalyzed azide-alkyne cycloaddition reaction, known as click chemistry (Fig 1). Initially, PMOXAs incorporating alkyne functionality were synthesized via cationic ring opening polymerization technique. The living polymerization was terminated with ethyl piperidine-4-carboxylate and further hydrolysis with NaOH to obtain carboxyl terminated PMOXA. A monolayer of silane with azide functionality was prepared for covalent attachment of PMOXA to the surface. The course of the reactions was investigated by contact angle, XPS and ellipsometry.

**RESULTS:** Successful completion of click reaction between the azide terminated surfaces and PMOXA was confirmed using XPS analysis. Specifically, the XPS analysis of

PMOXA modified surface showed an increase in the nitrogen signal at around 400 eV.



*Fig. 1. Schematic illustrations of a silicon oxide surface functionalized with azide-terminated silane monolayer showing formation of triazole ring after click reaction with PMOXA.*

The presence of covalently attached vancomycin on PMOXA-COOH coated surfaces was confirmed by antibody labelling. Both PMOXA and vancomycin functionalized PMOXA surfaces were tested using *S. epidermidis*. The PMOXA itself was shown to be biopassive using plate counting technique, but the incorporation of vancomycin lead to increased biofouling, as seen by the presence of dead bacteria on the surface after staining the cells with fluorescent Live/Dead viability kit.

**DISCUSSION&CONCLUSIONS:** In this initial work we demonstrated that PMOXA can be used as platforms to covalently immobilize vancomycin preserving its functionality. However, there are a number of additional issues that we currently investigate: the site of vancomycin modification and the surface density of polymer chains on the surface.

**REFERENCES:** <sup>1</sup> Del Pozo, et al., *N. Engl. J. Med.* 361 (8) (2009) 787. <sup>2</sup> Zimmerli, et al., *N. Engl. J. Med.* 351 (2004) 1645. <sup>3</sup> Konradi, et al., *Langmuir* 24 (3) (2008) 613. <sup>4</sup> Rostovtsev, et al., *J. Am. Chem. Soc.* 124 (14), 2596, (2002).

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