

Synthesis and characterization of diblock copolymers containing antifouling and self-polishing groups

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Surfaces that prevent biofouling from any type of microorganism are known as antifouling surfaces. These are usually developed by the modification of a surface with a hydrophilic polymer coating. Such polymers resist protein adsorption, cell and microorganism adhesion, and thereby minimize unwanted biological responses [1]. Antifouling surfaces are continuously being developed for a plethora of applications spanning from biomedical tools, packaging management, marine technology and navigation.

The main target of this work was to develop new polymeric materials exhibiting controllable antifouling properties in the solid state. These polymeric materials comprise environmental friendly biocidal species and can self-organize into bulk nanostructures to give surfaces with controlled self-polishing and antifouling features. Amphiphilic diblock copolymers (fig. 1) containing hydrophobic and hydrolyzable THPMA (tetrahydropyranyl methacrylate) units and hydrophilic tertiary amine containing DMAEMA ((2-dimethylamino)ethyl methacrylate) moieties were synthesized using group transfer polymerization and were characterized by GPC and ¹H NMR [2]. Symmetric diblock copolymers were designed expected to assemble into lamellae structures in the solid state. Alkyl iodides were used for the quaternization of the DMAEMA units in order to introduce the biocidal groups (fig. 1).

Thin films of the quaternized PDMAEMA-*b*-PThPMA diblock copolymers were spin coated from an ethyl lactate solution onto quartz and silicon wafers and the chemical changes on the polymer as a function of temperature were monitored by UV-vis and FTIR spectroscopies. Furthermore, the thickness and the hydrophilicity of the films were measured by ellipsometry and contact angle measurements.

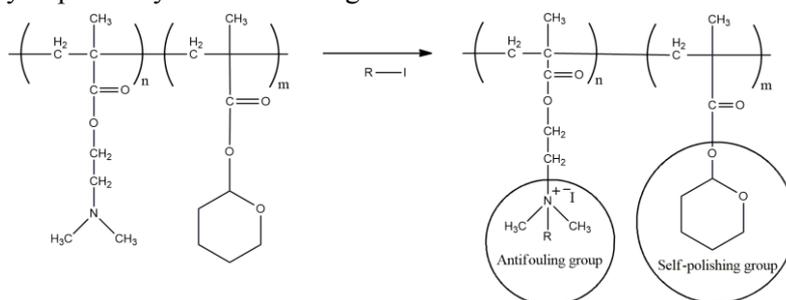


Figure 1: Chemical structure of the PDMAEMA-*b*-PThPMA diblock copolymer and the quaternized analogue

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References

- [1] A. B. Lowe, M. Vamvakaki, M. A. Wassall, L. Wong, N. C. Billingham, S. P. Armes, A. W. Lloyd J. Biomed. Mater. Res. **52**, 88 (2000).
- [2] C. S. Patrickios, et al. Macromolecules **27**, 930 (1994).