NOVEL POLYMER BRUSHES FOR ANTIFOULING SURFACES

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Environmentally friendly polymeric materials have attracted significant research interest in scientific areas that require "clean" surfaces and "sterile" conditions such as sensitive sanitary and marine applications. Polymer chains, which are covalently bound onto flat surfaces and bear biocidal species, are particularly advantageous because they remain onto the surface even when it is immersed in water. [1]

In this work, homopolymer brushes based on 2-(dimethylamino)ethyl methacrylate (DMAEMA) were grown on silicon and glass substrates using the "grafting to" or the "grafting from" approach. In the "grafting to" technique, preformed polyDMAEMA chains bearing alkoxysilane end-functionalities were synthesized via atom transfer radical polymerization (ATRP). The polymer amine groups were quaternized using alkyl halides to form the quaternary ammonium moieties which exhibit a biostatic action and next, the polymer chains were reacted with the hydroxy-silane functionalities on the solid substrates (Figure 1). On the other hand, in the "grafting from" method, ATRP initiator molecules were immobilized onto the solid surfaces to form a self-assembled monolayer (SAM) followed by surface-initiated ATRP of DMAEMA (Figure 1). Quaternization of the tertiary amine groups of the polymer brushes produced a polymer film with biocidal properties. The quaternized polyDMAEMA chains were characterized by ^{1}HNMR spectroscopy and gel permeation chromatography (GPC) while the morphology and the thickness of the polymer brushes were characterized by atomic force microscopy (AFM), infrared spectroscopy (FTIR) and ellipsometry. [2] The surface wettability was identified by water contact angle measurements.

The polymer grafting density, brush thickness and degree of quaternization was varied and its influence on the biocidal behaviour of the polymer layer is under investigation.

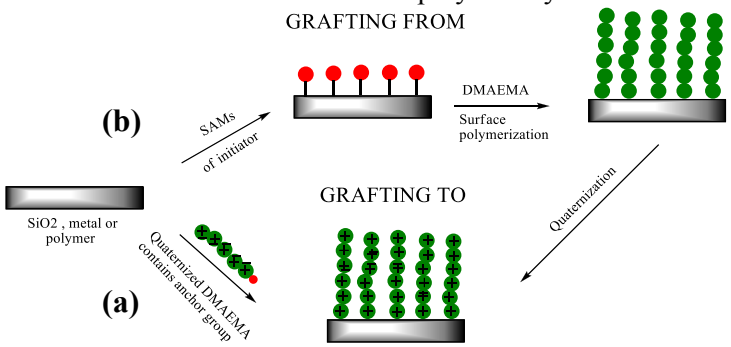

Figure 1: Synthesis of quaternized polyDMAEMA brushes by the "grafting to" (a) and the "grafting from" (b) technique

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References

[1] J. P. Youngblood, L. Andruzzi, C. K. Ober, A. Hexemer, E. J. Kramer, J. A. Callow, J. A. Finlay, M. E. Callow, Biofouling **19**, 91 (2003).

[2] A. Mateescu, J. Ye, R. Narain, M. Vamvakaki, Soft Matter **5**, 1621 (2009).

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