

VERSATILE BIO-INSPIRED STRATEGY FOR IMPARTING ROBUST ANTIBACTERIAL PROPERTY TO STAINLESS STEEL

Emilie Faure,^a Philippe Lecomte,^a Christelle Vreuls,^b Cécile Van De Weerd,^b Catherine Archambeau,^c Joseph Martial,^b Christine Jérôme,^a Anne-Sophie Duwez^d and Christophe Detrembleur^a

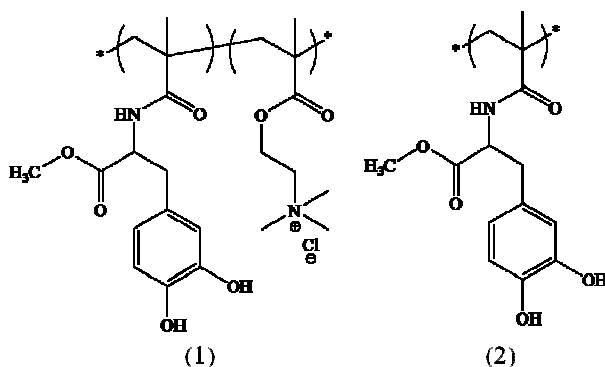
^a Center for Education and Research on Macromolecules (CERM), University of Liège, Sart-Tilman, B6, Liège

^b GIGA-Research, University of Liège, B34 Sart-Tilman, Liège

^c ArcelorMittal Liège Research, Bd de Colonster B57, Liège

^d Nanochemistry and Molecular Systems (NANOCHEM), University of Liège, Sart-Tilman, B6, Liège

The synthesis of two poly(methacrylamides) bearing 3,4-dihydroxyphenylalanine inspired from the chemical composition of mussel adhesives will be presented. First a copolymer with quaternary ammonium groups, P(mDOPA)-co-P(DMAEMA⁺), has been prepared to afford versatile adhesion to every kind of substrates and promote Layer-by-Layer building process (Scheme 1; (1)).¹ This DOPA-functionalized monomer has also been homopolymerized (Scheme 1; (2)) to insure a multilayer film growth by covalent coupling with a homopolymer containing amino groups.² The film cross-linking is made possible by adequately controlling both the redox state of the polymer and the pH of the solutions. This cross-linking is evidenced by solid-state ¹³C NMR with the occurrence of a typical signal of imine, traducing the Schiff base formation during film growth. Antibacterial property has then been imparted to stainless steel using the same coupling reaction and an antibacterial peptide, Nisin. Antibacterial activity against the Gram positive bacteria *Bacillus subtilis* is preserved even after long immersion time, as the result of the peptide covalent anchoring on the surface. All the processing steps, including the synthesis of the polymers and the peptide grafting, are performed in aqueous solutions under mild conditions.



Scheme 1 : Chemical structures of (1) P(mDOPA)-co-P(DMAEMA⁺) and (2) P(mDOPA).

References:

- 1) Charlot et al., Journal of Materials Chemistry, 2009, 19, 4117.
- 2) E. Faure, P. Lecomte, S. Lenoir, C. Vreuls, C. Van De Weerd, C. Archambeau, J. Martial, C. Jérôme, A.-S. Duwez and C. Detrembleur, „Sustainable and Bio-inspired Chemistry for Robust Antibacterial Activity of Stainless Steel“, submitted.