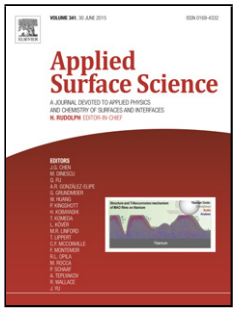

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Impact of hydrophilic and hydrophobic functionalization of flat TiO_2/Ti surfaces on proteins adsorption

Héloïse Fabre[1], Dimitri Mercier[2], Anouk Galtayries[2], David Portet[3], Nicolas Delorme[1], Jean-François Bardeau[1]

[1]Institut des Molécules et Matériaux du Mans, UMR CNRS 6283, Université du Maine, Université Bretagne-Loire, Avenue Olivier Messiaen, 72085 Le Mans Cedex 9, France

[2]Chimie ParisTech, PSL Research University, CNRS, Institut de Recherche de Chimie Paris (IRCP), 75005 Paris, France

[3]Surfactis Technologies, 22 rue Roger Amsler, 49100 Angers, France

Highlights

- TiO_2 surface functionalizations were prepared using bisphosphonate groups
- Hydrophilic surfaces limited the absorbed amount of BSA and fibrinogen
- Similar rigidity of protein layers was observed whatever the surface wettability

ABSTRACT

Controlling adsorption of proteins onto medical devices is a key issue for implant-related infections. As self-assembled monolayers (SAMs) on titanium oxide represent a good model to study the surface-protein interactions, TiO_2 surface properties were modified by grafting bisphosphonate molecules terminated with hydrophilic poly(ethylene glycol) groups and hydrophobic perfluoropolyether ones, respectively. Characterisation of the surface chemistry and surface topography of the modified surfaces was performed using XPS and atomic force microscopy (AFM). Quartz-crystal microbalance with dissipation (QCM-D) was used to determine the mass of adsorbed proteins as well as its kinetics. Poly(ethylene glycol)-terminated SAMs were the most effective surfaces to limit the adsorption of both BSA and fibrinogen in comparison to perfluorinated-terminated SAMs and non-modified TiO_2 surfaces, as expected. The adsorption was not reversible in the case of BSA, while a partial reversibility was observed with Fg, most probably due to multilayers of proteins. The grafted surfaces adsorbed about the same quantity of proteins in terms of molecules per surface area, most probably in monolayer or island-like groups of adsorbed proteins. The adsorption on pristine TiO_2 reveals a more important, non-specific adsorption of proteins.