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Amphiphilic copolymer coatings by Plasma polymerization process: characterization and evaluation of antifouling properties

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Non-specific adsorption of proteins and associated bio-adhesion is one of the most significant limitations to the end point utility of many biomaterial devices. The most recent approach for surface treatment of materials to reduce surface biofouling is based on amphiphilic nanostructured coatings, showing compositional, morphological and topographical surface heterogeneity. The amphiphilic coating is composed of two components, one hydrophilic and the other hydrophobic in nature. The intrinsic incompatibility of these two components leads to phase segregation and consequently leads to surfaces with compositional, morphological and topographical surface heterogeneity in the nanoscale. The latter would result in a surface which is energetically unfavorable for protein or glycoprotein adsorption, thereby weakening the adhesion strength of the entire organism with the surface.
In this work amphiphilic coatings with nano-heterogeneity have been obtained by plasma co-polymerization, of 1H,1H,2H,2H-perfluorodecyl acrylate (PFDA) and diethyleneglycol dimethyl ether (DEGDME) in an inductively coupled low pressure RF reactor using the pulsed or continuous mode at low power. Coatings with different compositions were prepared by using two precursor feed lines and varying their ratio by the carrier gas Ar flow rate. The plasma-polymerized coatings were characterised by contact angle, Fourier transform infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS), field emission scanning electron microscopy (FESEM) and Atomic force microscopy (AFM). The fluorocarbon coatings were investigated for their antifouling characteristics against two model proteins namely, Ovalbumin and Fibrinogen, using (QCM) and found to show good antifouling characteristics. PFDA-co-DEGDME showed switching properties in terms of wettability depending on the storage medium. The properties of such coatings were compared to the plasma co-polymerization of PFDA with an unsaturated polyethyleneoxide (PEO) which was the diethyleneglycol vinylether(DEGVE). The latter had a higher deposition rate as compared to the saturated precursor i.e. DEGDME which gave a deposition rate of 20nm/min.

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