Title: The study on interactions of functional surfaces with biological systems

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Abstract: This work is devoted to the study of processes influencing the performance of functional antifouling polymer brush coatings and their interactions with complex biological media. Specifically, both results of the fundamental and applied research on the i) functionalization processes influencing coating resistance, ii) tailoring of the physico-chemical properties of the antifouling coatings to minimize the nonspecific interactions with complex biological samples, and iii) behavior and performance of the polymer brush coatings in varying environments are presented. Acrylamide and methacrylamide-based polymer brushes with side hydroxyl, carboxybetaine, and sulfobetaine groups were studied, showing the great potential of their optimized copolymer structures as tunable antifouling functionalizable platforms for cell research or biosensor applications. Moreover, newly developed procedures for antifouling properties recovery after EDC/NHC activation and functionalization of poly(carboxybetaines) serves effectively to suppress nonspecific interactions while enhancing biorecognition capabilities. The acquired knowledge was successfully implemented in the applications, presenting newly developed antifouling biorecognition coatings and optimized functionalization processes as promising tools in cell research, or food-safety, and biomedical biosensing.

Keywords: antifouling functional coatings, zwitterionic polymer brushes, biosensors, functionalization, fouling