

THE STUDY ON INTERACTIONS OF FUNCTIONAL SURFACES WITH BIOLOGICAL SYSTEMS

Submitted by **Ivana Víšová**

Submitted for the degrees of Doctor of Charles University, FACULTY OF
MATHEMATICS AND PHYSICS

Study program: Physics

Specialization: Biophysics, chemical and macromolecular physics

“Examiners’ Detailed Comments”

Behind the quite generally formulated title are mainly acrylamide and methacrylamide-based polymer brushes with side hydroxyl, carboxybetaine, and sulfobetaine groups adherent to solid supports. These polymer films were characterized by Surface plasmon resonance (SPR), Spectroscopic ellipsometry, Quartz crystal microbalance (QCM), Infrared spectroscopy, Contact angle measurements, scanning electron microscopy (SEM) and atomic force microscopy (AFM). An additional asset of this PhD work is the presentation of procedures for antifouling properties recovery after EDC/NHC activation and functionalization of poly(carboxybetaines) serving effectively to suppress nonspecific interactions while enhancing biorecognition capabilities.

Specifically, in the thesis, the drying and swelling behavior of zwitterionic polybetaine brushes was monitored by spectroscopic ellipsometry and QCM, with the results that the repetition of these processes leads to a more advantageous arrangement of the change and supposedly to significantly improving the fouling resistance. Next, it was shown that reported functionalization of polybetaine brushes leads to a disruption of the chain arrangement and substantial changes of surface physicochemical properties such as charge state, resulting in a deterioration of antifouling properties. Beside of these characterization studies, two advanced copolymer brush architectures were developed with the result of a significant improvement

in the properties of the functionalized platform. After that the use of these copolymer brushes in several applications related to advanced biochip technologies for food safety and biosensors for medical applications were outlined.

I conclude that Mgr. Ivana Víšová proved her scientific competence during her PhD studies. The results obtained in the course of this work contributed to 8 papers published in peer-reviewed journals, 4 manuscripts submitted or in preparation, and 7 outcomes of the applied research in a form of patent applications and functional samples. In 2 out of this 8 already published papers she serves as the first author.

Overall the scientific content of the thesis fulfills the standards for obtaining a PhD. The thesis impresses by the large amount of scientific results presumably gained in more than 7 years. I conclude, that the author of the thesis proved to have the ability to perform research and to achieve scientific results. I do recommend the thesis for presentation with the aim of receiving the Degree of Ph.D.

Prague, 20.3.2021

Prof. Dr. Martin Hof, DSc.