Electrochemical characterization of poly(ether sulphone) supported layer-by-layer self assembly for membrane protein studies

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"Electrochemical characterization of poly(ether sulphone) supported layer-by-layer self assembly for membrane protein studies."

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During the last decades layer-by-layer (LbL) assembly of polyelectrolyte multilayers [1] has emerged as an excellent way to modify and functionalize surfaces. Therefore it has found a great application in a numerous fields including biomimetics, biosensors, tissue engineering, protein and cell adhesion or drug delivery systems [2].

In the present study we investigate the functionality of a biomimetic film composed of cross-linked polyelectrolyte multilayer assembly with incorporated negatively charged polymersoms containing proton driven pump - bacteriorhodopsin. The polyelectrolyte multilayer film prepared by alternating deposition of polyethylenimine (PEI) and poly(styrene sulfonate) (PSS) polyelectrolytes were formed on the porous poly(ether sulphone) PES supporting membrane immobilized via a hydrogel layer on the gold electrode microchip and characterized by means of electrochemical impedance spectroscopy (EIS). Functionality of polymersoms with light induced bacteriorodopsin was tested by amperometry. The presented data demonstrate that the proposed biomimetic film based on polyelectrolyte assembly on PES support is suitable for membrane protein incorporation and may find an application in construction of biosensors.

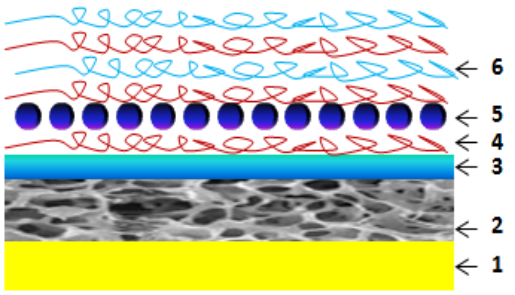

Fig. 1: Schematic representation of the system composed of 1) gold electrode microchip, 2) hydrogel, 3) PES membrane support, 4) PEI polyelectrolyte, 5) polymersoms with bacteriorhodopsin, 6) PSS polyelectrolyte.

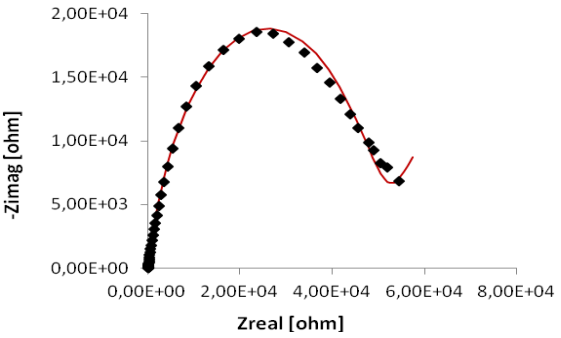

Fig. 2: Nyquist plot of the redox process of $[Fe(CN)_6]^{3-/4-}$ on the cross-linked LbL assembly on the PES support immobilized via hydrogel tethering on a modified gold electrode microchip. Red line represents fitting to equivalent circuit model.

[1] C. Picart, *Curr. Med. Chem.*, **15** (2008) 685.
[2] Z. Tang,Y., I. Wang, P. Podsiadlo, P. Kotov, *Adv. Matter.*, **18** (2006) 3203.