Designing polyelectrolyte nanolayers formed by complex architecture polymers *via* surface initiated atom transfer radical polymerization

A. Hochół[1], M. Flejszar[1], K. Ślusarczyk[1], P. Chmielarz[1*], M. Wytrwał[2]

[1] *Department of Physical Chemistry, Faculty of Chemistry, Rzeszow University of Technology, Al. Powstańców Warszawy 6, 35-959 Rzeszów, Poland*
[2] *Academic Centre for Materials and Nanotechnology, AGH University of Science and Technology, al. A. Mickiewicza 30, 30-059 Krakow, Poland*

[*]p_chmiel@prz.edu.pl

Surface-initiated atom transfer radical polymerization (SI-ATRP) was successfully applied to modify Si wafers surface with complex ampholitic polymer brushes [1]. Step-by-step SI-ATRP approach enabled the formation of bottlebrush-like polymers with a poly(2-hydroxyethyl methacrylate) backbone and cationic (poly(2-(dimethylamino) ethyl methacrylate) and anionic (poly(acrylic acid)) block copolymers side chains (Fig.1).

Syntheses protocols were designed on the basis of principles of green chemistry by reducing copper catalyst concentration (less than 300 ppm by wt), replacing toxic, organic solvents with easy to recycle ethanol [2] or water/ethanol mixture and conducting synthesis in room temperature. Furthermore, an extremely economically procedure, reducing consumption of reagents per cm^2 of modified surface by using microliter volumes of reagents (µL-scale SI-ATRP) [3] will be presented.

The successful modifications of Si wafers were confirmed by X-ray photo-electron spectroscopy (XPS) analyses and water contact measurement (WCA). XPS elemental analysis was performed for each stage of modification and enabled determination of percentage of total atomic concentration of detected elements on the modified surface. WCA measurements present behavior of amphiphilic brushes in various pH and the resulting divergent thickness of the brushes nanolayers.

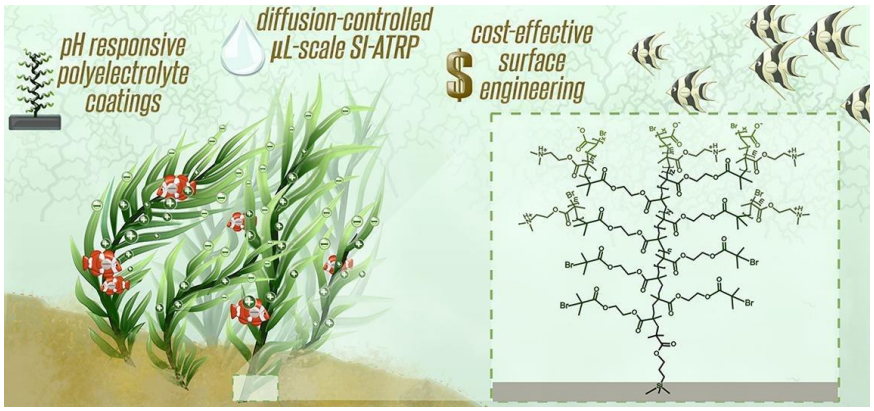

Fig. 1. Schematic representation of polyelectrolyte nanolayer.

Financial support from Ministry of Education and Science under the program "Students Research Clubs creates innovations" (Contract no: SKN/SP/569572/2023) and from National Science Centre in Poland as a part of the SONATA BIS 10 project (2020/38/E/ST4/00046) is gratefully acknowledged.

[1] M. Flejszar, K. Ślusarczyk, A. Hochół, P.Chmielarz, M. Wytrwal, K. Wolski, K. Spilarewicz, K. Awsiuk, J. Raczkowska, European Polymer Journal, **194**, 112142 (2023)
[2] M.N. Borand, F. Karaosmanoglu, Journal of Renewable and Sustainable Energy, **10**, 033104 (2018)
[3] K. Ślusarczyk, M.Flejszar, P. Chmielarz, Polymer, **233**, 124212 (2021)