NON-CYTOTOXIC, THERMO-SWITCHABLE ANTIBACTERIAL COATING BASED ON METALLIC NANOPARTICLES EMBEDDED IN POLYMER BRUSH FOR THE GLASSY COOKWARE.

Nastyshyn S. [1], Stetsyshyn Y.[2],Lishchynskyi O.[2], Shymborska Y.[1,2], Awsiuk K.[1], Budkowski A.[1], Raczkowska J.[1]

[1]Smoluchowski Institute of Physics, Jagiellonian University, Łojasiewicza 11, 30-348 Krakow, Poland

[2]Lviv Polytechnic National University, St. George's Square 2, 79013 Lviv, Ukraine

e-mail: svyatoslav.nastyshyn@doctoral.uj.edu.pl

The polymer grafted brushes are the polymeric chains that are grafted by one of their ends to a solid substrate. In our study we employ the polymer grafted brushes for thermo-switchable alignment of proteins and liquid crystals, for culturing the cells as well as for fabrication of thermo-stimulated antibacterial coatings.

To fabricate the thermo-switchable antibacterial coating the biocidal material should be embedded in thermo-switchable matrix that can control its release with the temperature. In this study we chose the poly(di(ethylene glycol)methyl ether methacrylate (POEGMA) brush as a thermo-switchable polymer matrix since it has conformational transition from coil to collapsed state at 16^0C. We chose silver nanoparticles as a biocidal material against bacteria.

We fabricated the POEGMA brush grafted to the glass substrate following the atom transfer radical polymerization. To incorporate the silver nanoparticles into the brush we employed the synthesis “in situ” procedure. To prove the presence of silver nanoparticles in the brush we employed the time-of-flight secondary ions spectrometry (ToF-SIMS) and X-ray photoelectron spectroscopy (XPS). The conformational transitions of the POEGMA brush was studied with the water contact angle measurements at different temperatures.

We studied the thermo-switchable antibacterial activity of POEGMA grafted brush with embedded silver nanoparticles aboveand below the temperaturesof conformational transition against model Gram-positive and Gram-negative bacteria andfound that above the conformational transition temperaturethe studiedbacteria perish.

For the potential human-related applications the cytotoxicity of the coatings must be examined. To perform such a study, the influence of silver nanoparticles on human cells was examined for two cell lines. Obtained results show no cytotoxicity for human skin cells of the coatings, extending significantly the possibility of their biomedical applications.

We expect that the coating of the glassy cookware (pots, pans, or dishes in which food can be cooked) with POEGMA grafted brush with embedded silver nanoparticles will prevent the reproduction of bacteria on its surface. The thermo-switchable antibacterial activity provides high durability of the antibacterial activity of the coating.