ANTIBACTERIAL ACTIVITY OF SILVER NANOPARTICLES GRAFTED ONTO PLASMA TREATED PET: EFFECT OF PREPARATION METHOD AND SHAPE OF NPs

Řezníčková A.[1], Nguyenová H.Y.[1], Lacmanová V.[1], Michalcová A.[2], Průša F.[2], Vokatá B.[3], Švorčík V.[1], Slepička P.[1]

[1]*Department of Solid State Engineering, UCT Prague, 166 28 Prague 6, Czech Republic*
[2]*Department of Metals and Corrosion Engineering, UCT Prague, 166 28 Prague, Czech Republic*
[3]*Department of Biochemistry and Microbiology, UCT Prague, 166 28 Prague, Czech Republic*

Antibacterial surfaces are a possible way to prevent bacterial infection. This study aim was to prepare antibacterial surface by grafting silver nanoparticles (Ag NPs) onto plasma activated polyethylene terephthalate (PET) surface via biphenyl-4,4'-dithiol (BPD). First goal of this study is preparation of antibacterial polymer surface by grafting polyethylene terephthalate (PET) with Ag NPs differing by method of preparation. Ag NP dispersions were synthesized by chemical (Ag NP_{CH}), electrochemical (Ag NP_E) and physical (Ag NP_P) methods. Secondly, is the shape factor take into account, which may significantly influence Ag NPs antibacterial properties, two different shape were used, spherical (Ag0) and triangular (Ag3). Ag NPs were characterized using UV-Vis spectroscopy, transmission electron microscopy (TEM) and further by high resolution transmission electron microscopy (HRTEM). Success of grafting was determined by X–ray photoelectron (XPS) and energy dispersive X-ray spectroscopies. Atomic force and scanning electron microscopes also showed presence of both thiol and Ag NPs on plasma treated PET. Prepared samples were subjected to antibacterial tests against *E. coli* and *S. epidermidis*. Average dimensions of NPs determined by TEM was 21.0 nm for Ag0 and (20.5 x 5.5) nm for Ag3. By HRTEM analysis was shape of Ag0 resolved as *decahedron* and Ag3 as *triangular nanoplates*. The highest antibacterial activity (for both strains) varying by preparation method turned out to be on PET grafted with Ag NP_P because far greater NP amount was situated more in the volume of grafted layer than on PET surface itself. In the case of shape effect of Ag NPs on bactericidal response Ag3-grafted sample had slightly better antibacterial activity against *S. epidermidis* than Ag0. *E. coli*, on the other hand, was not affected significantly by the prepared substrates, probably due to low concentration of grafted Ag onto surface.