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Plasma polymer based coatings with tailor-made antibacterial action

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Bacterial infection is a frequent complication associated with the use of medical implants. Onset of such implant-related infections is commonly connected with a biofilm formation on their surfaces. Once formed, a biofilm is extremely difficult to eliminate even with vigorous use of antibiotic treatments as the biofilm populations are less susceptible to most of known antibiotics. This often results in a necessity to increase the dosage of antibiotics and with it connected possible undesirable side-effects. An alternative strategy that gains increasing attention is to prevent biofilm formation on implanted devices that may be achieved by their coating with thin antibacterial films. In this study we investigated two possible approaches for production of such antibacterial coatings. The first one is based on the impregnation of nitrogen-rich plasma polymer film (magnetron sputtered nylon 66) with bioactive molecules (antibiotics in this study). It is shown that the amount of bactericidal agents released from the impregnated films as well their release kinetics may be controlled in the wide range either by the amount of impregnated bioactive molecules or by the additional barrier plasma polymer film deposited on the top of the antibiotics-loaded coatings. The second followed strategy was based on the use of plasma polymer/Cu NPs/plasma polymer sandwich structures that were prepared by combination of gas aggregation source of Cu NPs and magnetron sputtering of polymeric targets. The antibacterial efficiency of such nanocomposites was found to be again tailorable by the amount of Cu NPs or by the thickness of the top-most film of plasma polymer. Finally, it was proved that both strategies can be combined that may offer the possibility to design coatings with desired course of their antibacterial action.
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