TESTING OF NANOCRYSTALLINE DIAMOND FILMS AGAINST BACTERIAL BIOFILMS

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Abstract

Nanocrystalline diamond (NCD) films appear to be a promising material for many different applications due to their high physical and chemical stability, great range of possible surface modifications and easy production. NCD films were shown to be well biocompatible with tissue cells; however their possible antibacterial properties have been much less investigated.For our studies, we grew NCD films by chemical vapour deposition method on glass substrates and treated them by hydrogen, oxygen and CF4 plasma to achieve different wetting angles (70°, 5°, 100°, respectively). Apart from wetting angle measurements, the surface properties of NCD films were further examined by scanning electron microscopy, Fourier transform infrared spectroscopy, Raman spectroscopy and X-ray photoelectron spectroscopy.We present two methods of bacterial biofilm cultivation suitable for studying the bacterial growth on solid surfaces, which we will use for testing of possible antibacterial properties of NCD films. The first method comprises modified batch cultivation. The second method employs the commercially available CDC Bioreactor® for continuous cultivation of bacteria. For both methods Escherichia coli, a gram-negative bacterium, was used as the model organism. We show the preliminary results of experiments that aimed to the careful optimization of the experimental setup and procedures required for monitoring E. coli biofilm formation on glass and NCD films. Untreated glass will serve as negative control material in further studies that will thoroughly explore the potential ability of NCD film to reduce the bacterial growth.

Keywords: Nanocrystalline diamond films, antibacterial, continuous cultivation, FTIR, SEM, XPS, Raman spectroscopy

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