

Title: Nanoclusters coatings for biomedical applications

Author: Radek Divín

Department: Department of Macromolecular Physics (110. • 32-KMF)

Supervisor: RNDr. Ondřej Kylián, Ph.D.

Abstract:

The copper nanocluster films were prepared with the aid of the gas cluster aggregation source based on the principle of material sputtering from the magnetron target to the relatively high pressure of the working gas (Ar). The nanocluster films prepared in this way were subsequently overlapped with the layer of plasma polymer deposited by RF magnetron sputtering from the nylon polymer target in the atmosphere of the working gas (Ar, 2 Pa). A repetition of this procedure enabled to prepare nanocomposite layers having a multilayer character. These layers were subsequently investigated with regard to their morphology, chemical composition, surface wettability and optical properties. The chemical composition of the surface layer formed by nanocomposite films was determined by the X-ray photoelectron spectroscopy (XPS). It turned out that the chemical surface composition of prepared nanocomposites was not markedly influenced by the presence of the Cu nanoclusters. The morphology of prepared films was studied by the scanning electron microscopy (SEM) and the atomic force microscopy (AFM), which showed that the resulting roughness of prepared samples can be regulated in the range up to approximately 30 nm, in our experiment with the amount of deposited Cu nanoclusters. The different surface roughness had a significant effect on the wettability of samples – it was observed that with increasing roughness the wettability for the surface layer consisting of nylon 6,6 increased. Optical properties were studied by the UV-VIS spectroscopy. Thanks to this method, it was found that the prepared films exhibited anomalous absorption around 575 nm, while the intensity of the absorption peak increased with the amount of Cu nanoclusters in the samples. Unlike the intensity, the width of the absorption peak showed to be independent of the amount of Cu nanoclusters in nanocomposite layers.

Keywords:

Nanocomposites, nanoclusters, plasma polymers, wettability, surface roughness