Nanostructured thin films deposited by magnetron sputtering and gas aggregation sources of nanoparticles are studied especially with regards to their use in biomedical applications.

The possibility of using plasma polymers for the preparation of antibacterial coatings is tested first. It is presented that sputtered nylon 6,6 films may be impregnated by antibiotics. The subsequent release of antibiotics from such prepared reservoirs may be tuned by their thickness, chemical composition, or by an additional barrier layer. The second studied type of antibacterial coatings is based on metallic nanoparticles overcoated with sputtered PTFE. It is shown that by a proper choice of the number of nanoparticles and thickness of fluorocarbon overlayer, a significant antibacterial effect can be achieved while maintaining the biocompatibility of produced nanocomposite coatings. The possibility to enhance the antibacterial effect by impregnation of plasma polymer/nanoparticle nanocomposites by antibiotics is also verified.

Nanoparticle sources are used to study two-component films with 2D gradient character, too. A simple analytical model is developed allowing description and design of such nanomaterials. Its suitability is experimentally verified on 2D gradients combining Ag and Cu nanoparticles.

Finally, an original method allowing the detection of biomolecules by nanoparticle assisted laser desorption/ionization is developed and optimized in this work.