## UNIVERSITY POLITEHNICA OF BUCHAREST

DOCTORAL SCHOOL OF CHEMICAL ENGINEERING AND BIOTECHNOLOGIES



Abstract of Ph.D. thesis

## Nanostructured materials

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## ABSTRACT

The doctoral thesis "NANOSTRUCTURED NANOMATERIALS" is organized into two parts: the first one presents an overview of the current development of nanoparticles and surfaces with antibacterial applications, while de second one presents personal contributions. The research topic chosen for the current doctoral thesis aligns with international initiatives to develop antimicrobial nanoparticle-based formulations for biological applications. Specifically, the research studies focused on producing inorganic nanoparticles functionalized with bioactive agents and their further incorporation into thin films to obtain antimicrobial nanostructured coatings. In more detail, there were followed two main directions, namely: (i) enhancing the antimicrobial action of metal oxide nanoparticles through synergistic combinations with polymers and antibacterial compounds to create nanostructured delivery systems (i.e., nanoparticles and thin films); and (ii) preventing and reducing the contamination and colonization stages, while also bettering the control of recurring infections brought on by microbial biofilms, with the intention of surface-modifying medical devices with bioactive and nanostructured coatings using the newly discovered nanomaterials.

The features of the developed nanosystems and nanostructured surfaces were assessed using complementary techniques for advanced nanobiomaterials characterization. The therapeutic potential of the prepared nanomaterials was confirmed through *in vitro* and *in vivo* tests. The herein-reported research studies indicate that surface-functionalized nanoparticles hold great promise in preventing and treating bacterial infections, offering a safer and more efficient alternative to antibiotics. The present doctoral thesis aligns with the newest international trends, contributing to the scientific knowledge in the field via the development of original nanosized and nanostructured biomaterials for modern biomedical applications. The results obtained during the doctoral research activity, supported by their dissemination in Clarivate-indexed and ranked scientific journals, confirm and validate the novelty and importance of the developed nanostructured materials.