Fabrication of Gold Nano-Bipyramids towards their Implementation as Efficient Biosensing Enhancers and Thermo-Plasmonic Generators

Andreea Campu[1], Monica Focsan[1], Simion Astilean[1,2]
[1]Interdisciplinary Research Institute on Bio-Nano-Sciences, Babes-Bolyai University, Treboniu Laurean Str. 42, Cluj-Napoca 400271, Romania
[2]Biomolecular Physics Department, Faculty of Physics, Babes-Bolyai University, M Kogalniceanu Str. 1, Cluj-Napoca 400084, Romania
andreea.campu@gmail.com/ andreea.campu@ubbcluj.ro

Abstract

In the current biomedical nanotechnology scientific context, this work aims to develop, evaluate, and validate efficient and robust nano-systems based on gold nano-bipyramids (AuBPs). By the exploitation of the unique generated plasmonic and thermo-plasmonic properties of AuBPs, the proposed plasmonic designs exhibit great potential biosensing and therapeutic applications. Firstly, these elongated sharp nanoparticles were synthesized proving a great control over the fabrication process and thoroughly characterized. Next, the AuBPs were demonstrated to be active nano-antennas for the multimodal biodetection of target analytes in three efficient, low-cost, miniaturized and portable configurations, specifically, (i) immunosensor in aqueous solution, (ii) multiplexed paper-based plasmonic nanoplatform and (iii) integrated into a microfluidic channel nanodevice, respectively. Each developed nanoplatform was characterized and optimized following the evaluation of their limit of detection. Finally, the intrinsic photothermal and photodynamic properties were determined using two near infrared excitation wavelengths (i.e. 785 and 808 nm), thus allowing their further use in the fabrication of a hybrid nano-system incorporating a near infrared activable photosensitizer for enhanced dual photothermal and photodynamic therapy.

Keywords: Gold Nano-Bipyramids, Synthesis, Multimodal and Multiplexed (Bio)Detection, Intrinsic Photothermal And Photodynamic Properties, Dual Photothermal And Photodynamic Therapy
Domain: Physics
Section: Invited Presentation Elaboration of the doctoral thesis

Acknowledgements
This work was supported by the Babes-Bolyai University Research Funds – Doctoral Grants.