

Book of Abstracts

APMAS 2025



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15th International Advances in Applied Physics & Materials Science Congress & Exhibition (APMAS)



**Oludeniz, Turkey
October 21-27, 2025**

INVITED SPEAKER

Id-2902

Bimetallic and Trimetallic Luminescent Nanocomposites Applied as Multimodal Bio-Imaging and Sensing Platforms

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Abstract. Our research group focuses on metallic nanostructures applicable in environmental and/or biomedical fields. With respect to the studied nanomaterial applications, we are trying to exploit solely green chemistry and to obey the principles of responsible research and sustainability. The aim of our work is to develop a new type of nanocomposite (NCs), which can provide multimodal imaging and/or sensing possibilities. Recently, we have revealed several key issues influencing characteristic properties of luminescent gold nanoclusters (LGN), gold-platinum (LGPN), and/or gold-silver nanoclusters (LGSN) embedded in a protein template (1, 2, 3). Protein served as reducing and capping agent in these NCs. We were also investigating the advanced systems where super-paramagnetic iron oxide nanoparticles (SPIONs) are generated simultaneously with LGN in a one-pot sequential synthesis (4). Furthermore, we investigated even more advanced systems where LGSN in conjunction with SPIONs can be combined (5). Optimal conditions such as for instance: reactants ratio, pH value, medium composition, type of heating, time of maturing (6), purification, storage conditions; are found out by careful observation of synthesis and comparison of resulting NCs features. Thorough characterization of the as-prepared NCs is performed by several experimental techniques (including steady-state fluorescence and absorption spectroscopies, dynamic light scattering, zeta potential measurements, circular dichroism, scanning transmission electron microscopy and energy dispersive spectroscopy, X-ray photoelectron spectroscopy, electron paramagnetic resonance (EPR) and light-induced EPR, Moessbauer spectroscopy, inductively-coupled-plasma mass spectrometry). The application potential of purified NCs is further assessed in collaboration with the Institute of Clinical and Experimental Medicine in Prague (IKEM) by means of magnetic resonance relaxivity measurements (at 1.5T, 37°C), imaging (at 4.7T) and cytotoxicity evaluation (performed by the team of dr. Rárová at Palacký University Olomouc). Based on the results, our newly developed NCs possessing unique properties can serve as non-toxic bimodal contrast agents (4, 5) and/or for the detection of selected metal cations (6).

Keywords: Protein-Stabilized Nanoclusters; Multimodal Imaging Nanocomposites; Green Nanomaterial Synthesis.

Acknowledgement: Financial support by MZ VES (project no. NW25-08-00113) and Internal Grant Agency of Palacký University (IGA_PřF_2025_007) is thanked.

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