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Photo-active bimetallic and trimetallic nanocomposites in conjunction with macromolecules

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Nanocomposites can be described as entities containing functional nanoobjects within their structure. Frequently, different kinds of nanoobjects (e.g., nanoparticles and/or nanoclusters) are combined within one nanocomposite due to suitable macromolecules. Owing to this combination, multifunctional nanocomposites serving for multiple purposes can be prepared ^(1, 2, 3), i.e., from a single functionality based on the unique property of a nanomaterial, several different characteristic properties of nanoobjects can be exploited at the same moment. Obviously, nanocomposites containing two metals are usually denoted as bimetallic, while those composed of three metals as trimetallic. In this contribution, we are going to deal with noble metal nanostructures (Au and/or Au-Ag NSs) combined with iron oxide nanoparticles (IONPs) embedded in a macromolecular matrix and attached to a selected substrate. This combination could be used in solving environmental issues such as for instance: fluorescence detection of metallic cations ⁽³⁾, detection of pollutants via SERS, surface-enhanced Raman scattering spectroscopy ⁽⁴⁾, and/or regulation of bacterial growth due to antibacterial effect of nanocomposites ^(5, 6). Moreover, photo-Fenton reaction can take place owing to the presence of IONPs: in such cases, increased formation of hydroxyl radicals can be achieved, especially when using UVA light irradiation for a certain period. Consequently, pollutants can be destroyed and/or bacteria growth inhibited via the generated reactive-oxygen species (ROS) that are active for a short period. Thus, this contribution aims (i) to demonstrate the progress of our research group in the synthesis of such photo-active/photo-switchable bimetallic and/or trimetallic nanocomposites and (ii) to show the successful applications of the newly developed photo-active/photo-switchable bimetallic/trimetallic nanocomposites.

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