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NANO / Nanomaterials and nanostructured thin films

Synthesis and characterization of plasmonic composites (Fe/La)/Au for enhanced optical properties

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Abstract content

Metallic nanoparticles based on gold (Au) attract more and more attention due to their ability to enhance optical extinction by excitation of Surface Plasmon Resonance (SPR) that manipulates light-matter interaction. Mixing gold with magnetic materials like Iron (Fe) can lead to enhanced magneto-optical effects [1-3]. As Iron is sensitive to oxidation, the transformation of the non-noble metal in the nanoalloy will be studied, as well as its properties evolving upon oxidation between those of Fe/Au and those of Fe_2O_3/Au. $LaFeO_3$ can substitute Fe_2O_3. Both oxides are semiconductors but the former adopts a perovskite structure and it is considered as a promising photocathode material. Adding a gold buffer layer to perovskite affects the optical properties of the plasmonic oxide/Au composite, as shown by Wang et al. [4], in a way that is still to be investigated. In this work, we aim to apply femtosecond and nanosecond laser ablation to Fe/Au and $LaFeO_3$/Au thin films deposited by PVD technique on a quartz substrate to synthesize the NPs made of a mixture of these elements. Presently, we are working on deposition of Fe/Au and $LaFeO_3$/Au bi-layers by PVD in order to control their thickness, composition and structure before laser ablation. This second step is expected to melt both phases and form by quenching of the melt a composite. Thus-formed nanoparticles will be investigated by different techniques to correlate their composition and structure to their optical properties. Raman analyses, electron transmission microscopy, and emission spectroscopy will be used in that purpose.

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