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# Formation of alloy nanoparticles by laser ablation of Au/Fe multilayer films in liquid environment

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## Abstract

Laser ablation in liquids (LAL) emerged as a powerful technique for the synthesis of multielement nanoparticles (NPs) such as metal alloys with thermodynamically forbidden composition. Consequently, there is a great interest in expanding the current knowledge about NPs formation during LAL, in order to improve the control on product structure and to extend the range of compositions accessible by this technique. Here we performed a systematic investigation on alloy NPs formation by nanosecond LAL of Au/Fe/glass multilayers with different thickness and order of deposition. The experiments were carried out in ethanol and water, which have, respectively, favourable and unfavourable effects on alloy formation. Results were analyzed with optical absorption spectroscopy, transmission electron microscopy and Mie theory for simple and core-shell spheres. Since alloy NPs were obtained in all cases, our findings provide the evidence that the two metals are mixed during particles formation. Besides, our results suggest that the probability of interaction between ablated matter and solution species is higher for the topmost layer of the target, i.e. the one closer to the solid/liquid interface. This provide useful insight for the synthesis of nanoalloys with new compositions, that are of interest in several fields, from catalysis to photonics and nanomedicine.

## Keywords:

laser ablation, alloy nanoparticles, gold nanoparticles, iron nanoparticles, surface plasmon resonance

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