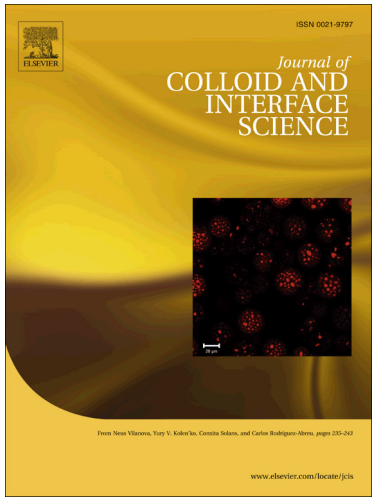

Editor's Choice$Feature Article$Regular Article

On the stability of gold nanoparticles synthesized by Laser Ablation in Liquids

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On the stability of gold nanoparticles synthesized by Laser Ablation in Liquids

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Abstract.

"Naked" gold nanoparticles (AuNPs), synthesized in the absence of any capping agents, prepared by pulsed laser ablation in liquid (PLAL) are stabilized by negative charges. Common explanations for this phenomenon involve the presence of gold oxides and/or the anion adsorption. We have found that AuNP ablated in solutions of acids with very different oxidation power, viz. HCl, H_2SO_4, HNO_3 share the same size and ζ-potential. Although, gold oxides have pKas≈ 4, the ζ-potential of AuNPs ablated in solutions with pH≤4 is always negative.

These evidences suggest that the gold oxidation and anion adsorptions have only a minor role on building the negative surface potential and we hypothesize, for the first time, that excess electrons formed within the plasma phase could charge the metallic particles. In our model, a crucial point is that the colloidal size of the NP maintains the energy of the electrons small enough to preclude chemical reactions but with a surface potential yet large enough to stabilize the AuNPs with respect to aggregation. A confirmation of the hypothesis of "electron-stabilized nanoparticles" is that either the addition of macroscopic metallic objects either the contact with a "grounded" copper wire induce the loss of charge and AuNPs aggregation.

Keywords: Pulsed Laser Ablation in Liquids; Colloidal stability; zeta-potential; surface'electron excess