Synthesis of nanoparticles by non-thermal laser ablation and supersonic cluster beam deposition

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Nanoparticles (NP) are strategic in many technologically important areas like heterogeneous catalysis [1-3], photo-assisted oxidation [4], medicine [5]. The synthesis of NP is largely based on wet chemical reduction [**Error! Bookmark not defined.**] or in some cases by pulsed laser deposition (PLD) using nanosecond (ns) laser pulses [6,7]. Although such methods allow the control over size and shape of the NP, pose several problems such as the use of colloidal stabilizers, the presence of impurities, the solvents and synthesis process costs to reduce or avoid the NP aggregation in solution. Moreover, in view of obtaining a controlled coating, the mere synthesis of the Ag NP does not imply a good adhesion of the obtained NP to substrate of choice.

Here we try to tackle some of the open problems by presenting the results obtained in the synthesis of NP by two different methods, supersonic cluster beam deposition (SCBD) [8,9] and femtosecond (fs) pulsed laser deposition (fs-PLD) [10]. In the former we employed SCBD to synthesize highly bactericidal coatings based on Ag NP directly on the surface of microscope slides, and we characterize the physical properties and the bactericidal action. In the latter we have shown that ambient pressure fs-PLD allows to obtain fractal TiO_2 nanostructures in crystalline form at room temperature on silicon substrates. Moreover, we discuss the behavior of the synthesized nanostructures with respect to other substrates like quartz and graphite. The perspectives and possible applications of such methods will be discussed.

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