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# Silicon Nanoparticles prepared via Laser Based Green Synthesis for energy and biomedical applications

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## Abstract:

During the last decade, silicon nanoparticles (Si-NPs) have triggered large research activity due to their particular size-dependent optical properties for the silicon based photonic technology. Recently, Si-NPs are emerging as promising nanostructures for potentials applications in biomedical field such as in vivo fluorescence imaging label[1], bio imaging contrast agent[2] and therapy[3]. Up to now, a variety of method have been developed for the Si-NPs synthesis.

In this work, we report the synthesis of NPs via Pulsed Laser Ablation in Liquid (PLAL). PLAL have emerged as an appealing alternative approach to generate pure metallic[4] and semiconductor[5] NPs. This versatile method, presents several advantages compared with the chemical method, i) Preparation is simple and clean since the synthesis can be carried out in water or in solution of a biocompatible ligand ii) Direct solubility of the product in polar solvent due to unique NPs surface chemistry. Si-NPs is produced by femtosecond pulsed laser ablation of silicon target in deionized water. The obtained colloidal solution are characterized by different techniques : Optical spectroscopy, microRaman spectroscopy, HRTEM and STEM measurements. Size control of Si-NPs via PLAL is obtained changing the laser pulse energy. Figure 1 shows STEM and HRTEM image of the obtained Si-NPs at lower laser pulse energy. Moreover, effects of the liquid environment revealed to play a key role on the microstructure of the obtained Si-NPs and on the optical properties of the colloidal solution.

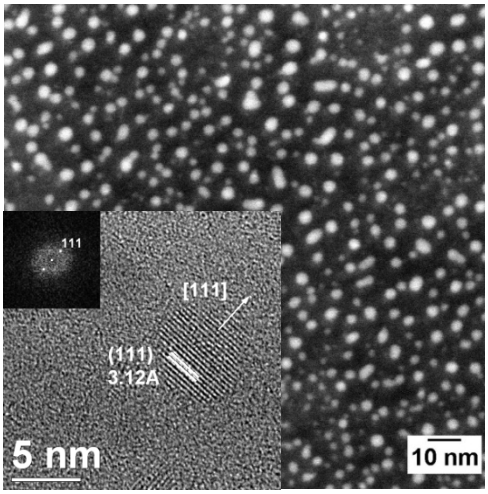


Figure : STEM image of ultra small Si-NPs prepared in deionized water via laser based method. In inset is reported HRTEM image of a single synthesized Si-NP showing the (111) lattice sets and its corresponding numerical electron diffraction pattern.

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