Laser-synthesized nanoparticles for biomedical and tissue engineering applications

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Abstract:

Driven by surface cleanness, unique physical and chemical properties, bare (ligand-free) laser- synthesized nanoparticles (NPs) are now in the focus of intensive research in a wide range of applications including environment, catalysis and biomedicine. Indeed, based on the interaction of ultrafast laser beam in liquid ambiance (e.g., aqueous solution) with a solid target material, this process leads naturally to the formation of spherical NPs with modulate physicochemical properties including diameter and size dispersion, surface chemistry and oxidation rate [1]. Recently, in our group we have thus demonstrated the possibility to elaborate ultraclean and very stable colloidal suspension of AuNPs and SiNPs with unique physicochemical properties for biomedical applications [1-3]. For instance, we have shown the possibility to modulate the dissolution behavior of SiNPs by varying the amount of dissolved oxygen in water [2]. We have also evidenced the complete safety properties of AuNPs and SiNPs using in vivo nude mice animal model [4,5]. As one of the major results, we shown that the SiNPs can be also exploited as significant sensitizers of radiofrequency (RF)-induced hyperthermia on Lewis lung carcinoma with efficient tumor inhibition at relative low concentration [6]. Very recently, we have also elaborated promising alternative plasmonic tools based on TiN NPs for potential photothermal therapy modalities [7]. Beside conventional

additives mainly made-it by chemical way, we have also started to explore such bare laser synthesized NPs as novel functional additives for tissue engineering applications [8].

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