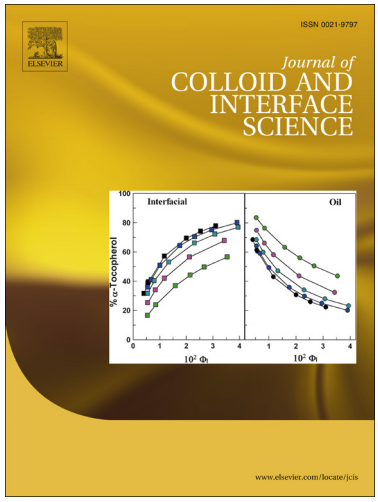

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Direct surface modification of ligand-free silicon quantum dots prepared by femtosecond laser ablation in deionized water

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Abstract :

Amine-terminated, ultra-small silicon nanoparticles (Si-NPs) were prepared in one step avoiding the conventional chemical or thermal treatment of Si surface, by introducing organosilane in freshly Si-NPs colloidal solution prepared by ultra-fast laser ablation of silicon target in deionized water. Surface chemistry studies of Si-NPs conducted by Raman and Fourier infrared spectroscopy demonstrated the hydroxyl-terminated surface of Si-NPs (i.e. internal oxidation free). The reactivity of hydroxyl-terminated surface with aminopropyltriethoxysilane in aqueous solution was investigated. Electron microscopy, dynamic light scattering, infrared spectroscopy and stability studies confirmed the successful functionalization of Si-NPs leading to 5 nm Si dots covered by aminopropyltriethoxysilane thick layer. Detailed infrared spectroscopy analysis of the Si-O-Si region as a function of immersion time revealed the formation of interfacial Si-O bonds between the organosilane and hydroxyl groups of the nanoparticles. The biocompatible Si nanostructure containing amine functional group prepared using a one-step green protocol, open the route for biomedical applications and successful translation into clinical setting, as bio-labels, contrast agents and vector delivery.