DEVELOPMENT OF LUMINESCENT SILICON NANOPARTICLES FOR BIO-IMAGING APPLICATIONS

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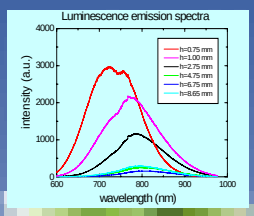
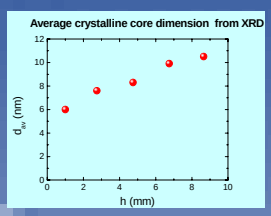
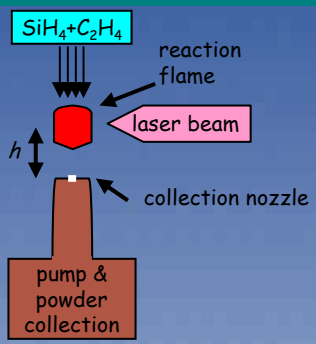
Si quantum dots (QD) can be alternatives to fluorophores based on organic molecules or II-VI semiconductor QD

key property for this application is the luminescence emission which depends both on particle size and on surface termination

Si-QD are synthesized in form of nanopowders by laser assisted pyrolysis of SiH_4





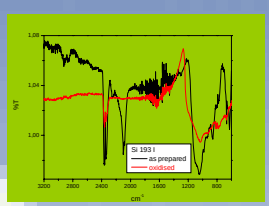


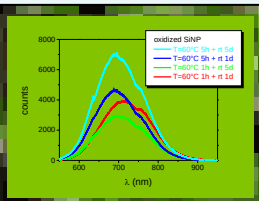
We can successfully control the size and luminescence properties by varying the collection nozzle position

Use of a nozzle to collect powders

OPTIMIZATION OF SIZE AND SURFACE TERMINATION

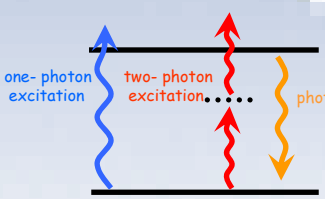
wet-chemical oxidation

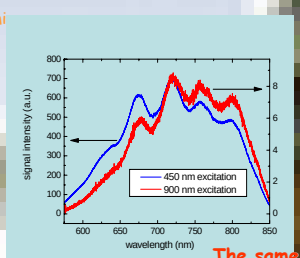


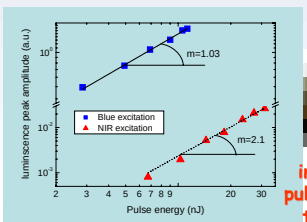


Wet chemical oxidation improves the surface oxide stoichiometry as shown by FTIR and increases luminescence emission

Advanced imaging techniques use two-photon excitation (TPE) of luminescence





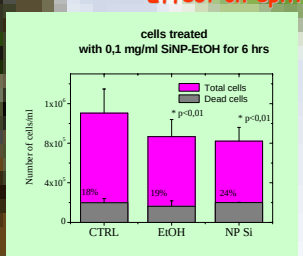


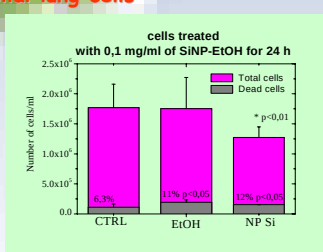
The quadratic dependence of luminescence intensity vs laser pulse energy reveals true two-photon excitation

The same luminescent levels can be excited by one or two-photon absorption

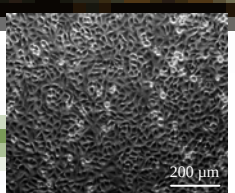
For in-vivo bio-imaging applications the Si-QD citotoxicity must be studied

Effect on epithelial lung cells



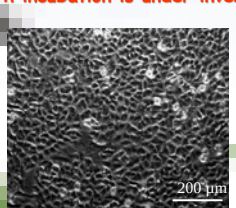


Cells mortality is not increased by the presence of Si nanoparticles. The reduction of cells number after 24 h incubation is under investigation



in EtOH for 24 h

the cell plasma membranes are well connected each other



in SiNP-EtOH for 24 h

the plasma membranes are somehow irregular

In conclusion some important steps, from synthesis optimization to functional characterization, have been done towards the development of an advanced functional nanomaterial

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