Hybrid inorganic nanoparticles for optical imaging and sensing

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Abstract

The optics and photonics scientific community recently focused on nanostructured materials due to their small size and functional properties, which make them appealing as tools for applications in biomedicine. Within this field, bio-imaging and sensing constitute research topics of great concern. Several photoluminescent probes have been exploited so far, such as organic dye molecules, nanoparticle clusters and quantum dots. In particular, some of them are especially suitable for imaging due to their unique properties, such as slow cooling of hot carriers and tunable absorption/emission via relatively simple processing techniques. The main drawback of quantum dots lays on the high toxicity of conventionally employed semiconductors, which cannot be used for living cell imaging nor during *in vivo* experiments. Therefore, the request for similar non-toxic materials represents an issue of utmost importance in view of any practical biomedical applications. In this work, uncommon semiconductor nanoparticles, such as porous silicon and zinc oxide ones, are proposed as promising candidates for both biocompatibility and tunability of the optical band-gap. Functionalization and passivation of nanoparticles surface is a key step toward *in vivo* imaging and sensing. Among many procedures experimentally validated, hydrosilylation with undecylenic acid in mild conditions is successfully used to prevent the strong surface oxidation of pristine porous silicon nanoparticles via passivation with Si-C groups, thus stabilizing them in buffer solution at physiological pH. The optical characterization study reveals interesting photo-emissive properties and pave the way towards biomedical applications.