A New Strategy for the Synthesis of Silicon Nanoparticles in Supercritical Medium

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ABSTRACT

Since the discovery in 1990 of photoluminescence in nano-structured silicon [1], growing efforts have been devoted to the study of this material. Nanosilicon has gained attention especially because, due to its low toxicity, it appears to be an ideal alternative to group II-IV semiconductors bio-markers [2]. Recently, it has been also shown that sub-micrometer sized Si particles are theoretically optimal subunits for the fabrication of all dielectric metamaterials active in the infrared and in the visible spectrum [3]. In this oral communication we will present a novel synthesis of silicon nanoparticles in supercritical media, produced using a combination of relatively stable and non-pyrophoric precursors. One of this precursor has never been used before to produce silicon nanoparticles. The ratio between these two precursors can be adjusted, to change the elemental composition, the physical properties and the yield of the obtained particles. The particles have been characterized by Raman, infrared, UV-vis, photoluminescence and by photoelectron spectroscopy, electron transmission microscopy and X-Ray diffraction. Crystalline particles of sizes between 10 and 15 nm are directly prepared within the reactor, without the need for further purification or thermal processing. The silicon nanoparticles exhibit visible fluorescence, emitting between 300 and 400 nm, when excited with a source between 250-350 nm. We have varied experimental parameters in order to explore the underlying synthetic mechanism. The synthesis was compared to a standard synthesis at low pressure, low temperature to assess the importance of the supercritical conditions in this novel process.

References

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