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Intrinsically stable oxidized silicon nanoclusters in aqueous solution

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Fluorescent silicon nanoclusters are of considerable interest, both as means of studying the fundamental properties of silicon, the most important technological material of our age, but also for their many possible applications. Luminescent clusters of silicon have applications in optoelectronic devices, as well as for biological labels and sensors, its low toxicity giving it an advantage over other light emitting materials. Here, fluorescent silicon nanoclusters are produced by deposition of silicon atomic vapour directly onto a liquid micro-jet. We have produced samples in different solvents such as water, ethanol and isopropanol. Of these solvents, water is especially important for medical application *in vivo*. Mixing silicon atomic vapour and water indeed yield a suspension that emit blue fluorescence when excited with UV light. The fluorescence wavelength is ranged from 350-420 nm, depending on the solvent. AFM measurements of clusters-film deposited on HOPG show the clusters are 1nm in height. Stern-Volmer plots of the fluorescence yield and the UV/Vis absorbance show that the fluorescent clusters are chemically stable and do not agglomerate over a storage time of years, without further chemical stabilization, suggesting the existence of an intrinsically stable form of fluorescent silicon nanoclusters in aqueous solution. Samples of silicon deposited in water jets exhibited a fluorescence quantum yield of 8-10% three years after production which is very promising for many applications such as medical and biological imaging and diagnostic labelling. Chemical analysis of nanoclusters films by XPS and IR spectroscopy reveal that the silicon is present in a high oxidation state and that the deep-blue fluorescence emerges from oxygen rich states.

Biography

Hanieh Yazdanfar has completed her PhD in Condensed Matter Physics (Nanoscien) at the University of Leicester. Her research area and expertise lies in the "synthesis, and optical and chemical characterisation of conductors and semiconductors especially fluorescent silicon nanoclusters". She was involved in design and fabrication of a device to produce nanoclusters by deposition of atomic vapour onto a liquid jet in vacuum. She has undertaken a broad range of experimental analyses on a series of materials specially silicon for electronics as well as drug delivery applications.

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