

Surface-Passivated Silicon Quantum Dot Phosphors

This technology offers a synthesis of brightly fluorescent colloidal silicon quantum dots that are low cost and produced at a large-scale compared to conventional methods that are high cost and toxic from heavy metal ingredients. The method involves electrochemical etching of silicon wafers to produce silicon nanoparticles that are heavy metal free, chemically stable, and economically viable.

What is the Problem?

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Semiconductor quantum dots (QDs) have shown great potential in solar energy harvesting and the next-generation lighting and display technologies. However, heavy metal toxicity and costly synthesis hinder their widespread commercialization. Silicon QDs have been investigated due to their lack of heavy metals (and thus non-toxic). However, most synthesis methods for these QDs require extreme conditions, special equipment, or complex chemical reactions, all of which make scale-up difficult.

What is the Solution?

SiQDs are heavy-metal-free and have abundant starting materials in nature and is a promising substitute for the toxic heavy metal based QDs. This technology is an experimental method coupled with a setup capable of synthesizing brightly fluorescent colloidal SiQDs in a low-cost and large-scale manner. The method begins with electrochemical etching of 6-inch silicon wafers to produce silicon nanoparticles, which are then further processed. These SiQDs have many applications, including QD display, LED phosphors, Organic LEDs, bio-imaging, photodetectors and solar cells.

What is the Competitive Advantage?

Current prevailing quantum dot chemistries have a high synthesis cost and toxicity from their heavy-metal ingredients, which might shadow their potential for large-scale production and wide-spread commercialization. With regards to silicon QDs, synthesis methods are high cost and would be difficult to scale up. This invention is a low-cost synthesis method for non-toxic QDs, and could prove comparably easy to translate to high volume manufacturing.

Technology ID

BDP 8667

Category

Materials/Nanomaterials
Selection of Available
Technologies

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Patent Information:

[US9373749B2](#)

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