



# High-Yield Plasma Synthesis of Luminescent Silicon Nanocrystals

**IP Status:** Issued US Patent; **Application #:** 11/155,340

## Radiofrequency Plasma Method

A single-step continuous flow non-thermal plasma process produces luminescent silicon nanocrystals. The nanocrystals, which range between 2 and 8 nm, can be produced within milliseconds. The process involves passing an argon-silane ( $\text{SiH}_4$ ) precursor gas mixture through a quartz reactor tube upon which radio-frequency power is applied through copper ring electrodes, generating a radiofrequency (RF) plasma. The nanocrystals created in this unique plasma environment are collected downstream from the plasma and produce consistent, desirable yields, easily scalable through parallelizing.

## Nanocrystal Synthesis Reduces Time and Cost

While luminescent silicon nanocrystals show great potential for use in a variety of applications such as optoelectronics, solid-state lighting for general illumination, fluorescent agents for biological applications, memory devices and other microelectronic devices, their widespread use has been hampered by the lack of ability to synthesize them in a fast, inexpensive and high-yield manner. Current methods of nanocrystal synthesis have inherent drawbacks. For example, liquid-phase methods often produce low yields, gas-phase approaches are prone to particle agglomeration, and high-rate laser pyrolysis processes require post-process etching to reduce the particle size, thus lowering the effective yield. This new single-step process easily and cost-effectively creates nanocrystals that require little to no post processing.

## BENEFITS AND FEATURES OF HIGH-YIELD PLASMA SYNTHESIS OF LUMINESCENT SILICON NANOCRYSTALS:

- Single-step process is easy, fast and cost-effective
- Consistently high yields are easily scalable
- Nanocrystals require little to no post processing
- Not prone to agglomeration

**Phase of Development** Pilot scale demonstration

**Technology ID**

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## Category

Engineering & Physical  
Sciences/Materials  
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Sciences/Nanotechnology  
Engineering & Physical  
Sciences/Semiconductor

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