Methods of Using Porous Silicon Nano/Micro-Particles for Time-Gated Fluorescence Imaging

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BACKGROUND

Fluorescence imaging is one of the most versatile and widely used visualization methods in biomedical research because of its high sensitivity, high spatial resolution, low cost, and non-invasive nature. In this method, a fluorescent probe molecule or nanoparticle is used to enhance contrast of the image in desired regions or to identify specific features, molecules, or tissues. However, *in vivo* fluorescence imaging has not been widely applied in clinical practice due to the lack of specific imaging agents, shallow tissue penetration of the exciting or emitting wavelengths, and ubiquitous background tissue autofluorescence. Conventional fluorescent probes based on organic molecules or quantum dots normally display short fluorescence lifetimes (on the order of a few nanoseconds). These lifetimes are comparable to the lifetimes of naturally occurring species in tissues and cellular media that are responsible for autofluorescence. This makes it hard to separate the fluorescence signal of the probe from background fluorescence in the time domain.

TECHNOLOGY DESCRIPTION

UC San Diego researchers have developed porous silicon nanoparticles (pSiNP) that can emit visible to near-IR light under photoexcitation, have long luminescence lifetimes (> 10 nanoseconds) and optionally contain quenching/stabilizing molecules that can adjust the luminescence lifetime and intensity from the nanoparticle. The invention also provides methods to fabricate said pSiNP and of time gating the emission of the pSiNP to enable higher fidelity imaging by eliminating background signals (e.g., tissue autofluorescence, spectral bleed through). In contrast to many nanomaterials, pSiNP degrade into renally cleared components in a relatively short period of time with little or no evidence of systemic or cellular toxicity. Moreover, due to their porous nature, the nanoparticles can carry additional species such as drugs, smaller nanoparticles, fluorescence sensitizers or fluorescence quenching agents.

INTELLECTUAL PROPERTY INFO

The invention has a patent pending and is available for licensing and/or sponsorship.

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OTHER INFORMATION

KEYWORDS

porous silicon, nanoparticles, time-gated fluorescence, in vivo fluorescence imaging, imaging agent, fluorescent probe, contrast enhancement

CATEGORIZED AS

- **Medical**
  - Diagnostics
- **Nanotechnology**
  - NanoBio
- **Sensors & Instrumentation**
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