

Highly stable, silica coated metal/alloy nanoclusters for use in bio-imaging and catalysis

EXECUTIVE SUMMARY

Stable, metal/alloy nanoclusters encapsulated in porous silica and the process of synthesis thereof. The nanoclusters find use as catalysts, possess unique optical activity (fluoresce in the Near IR region) with potential bio-imaging applications.

BACKGROUND

Ultra small metal clusters (<5 nm) exhibit enhanced optical, magnetic and electronic properties as compared to larger nanoparticles. But suffer from drawbacks like instability, chemical reactivity and agglomeration, which restrict their potential use in various applications. Encapsulation of the nanoparticles in thick oxide layers could overcome some of these problems, but impairs the catalytic process. Hence porosity in the oxide shell is necessary.

TECHNOLOGY DESCRIPTION

Stable metal/alloy nano clusters (as small as <2 nm) stabilized in water medium fluoresce in the Near IR region – leading to potential bioimaging applications. These nanoclusters are used as precursors for “nanoreactors”, encapsulated in porous, mono disperse silica particles (allowing diffusion of reactant molecules, preventing agglomeration and deactivation while keeping the catalytic activity of the clusters intact). Nanoclusters of various metals (like gold, palladium, silver) and their alloys can be achieved by this process. Encapsulation makes these “nanoreactors” highly sinter-resistant at high temperatures (at >700 °C).

MARKET POTENTIAL

The global nanocatalysts market is projected to reach \$6.0 billion by 2015, with the refinery/chemical industry segment being the largest, and the environmental applications segment growing fastest.

http://www.nanotech-now.com/news.cgi?story_id=32763

VALUE/ADVANTAGES

- Highly thermally stable nano particles (~3 nm >700 °C)
- Encapsulation in porous silica enables it to function as excellent catalysts (allowing diffusion of reactant molecules).
- Optical properties intact after silica encapsulation
- Simple, single step and cost effective process

APPLICATIONS

- Bio-imaging applications
- High temperature catalysis
- Silica coated Pd offers resistance to sintering, making it preferred material in catalytic converters in automobiles
- Near IR fluorescence enables bio-imaging

TECHNOLOGY STATUS

- Demonstrated at the lab scale
- On the lookout for potential partners for spin-off and licensing
- Patent application filed: [WO 2012/140675 A1](#)