



Superparamagnetic Magnetite Colloidal Nanocrystal Clusters

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OTHER INFORMATION

KEYWORDS

Biosensors, Chemical sensors, Bio-separation, Medical Imaging, Targeted delivery, Colloids, Nanocrystals, Superparamagnetic Colloids, Colloidal Nanocrystal Clusters, Magnetite, Catalysts, Catalyst support

CATEGORIZED AS

- ▶ **Materials & Chemicals**
 - ▶ Biological
 - ▶ Nanomaterials
- ▶ **Medical**
 - ▶ Delivery Systems
 - ▶ Diagnostics
 - ▶ Research Tools
- ▶ **Nanotechnology**
 - ▶ Materials
- ▶ **Sensors & Instrumentation**
 - ▶ Biosensors

RELATED CASES

2007-505-0, 2011-315-0, 2009-502-0,
2011-245-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,118,834	11/06/2018	2007-505

FULL DESCRIPTION

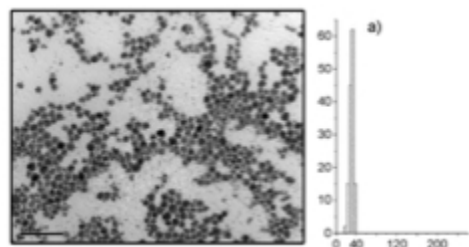
Background

Superparamagnetic nanocrystals are attractive for biomedical applications, as they are not subject to strong magnetic interactions in dispersion. Iron oxide nanocrystals have received the most attention for this purpose because of their biocompatibility and stability under physiological conditions. Robust approaches have been developed for synthesizing magnetic iron oxide (e.g., Fe₂O₃ or Fe₃O₄) nanocrystals with tightly controlled size distribution, typically by organometallic processes at elevated temperatures in nonpolar solvents. The challenges with these approaches are:

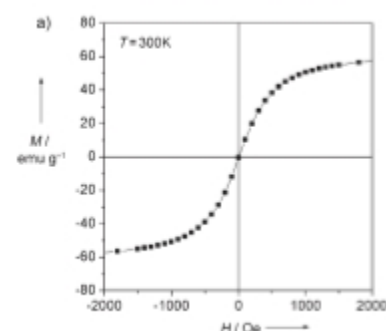
- ▶ Nanocrystals of the order of 10 nanometers (nm) have a low magnetization per particle making it difficult to control their movement in blood using moderate magnetic fields limiting their usage in bio-separation or targeted delivery.
- ▶ Increasing nanocrystal sizes induces paramagnetic-ferromagnetic transition making the crystals no longer dispersible in solution.

Current Invention

The current patented technology discloses the ability and the synthesis of highly water dispersible magnetite (Fe₃O₄) colloidal nanocrystal clusters (CNCs) with uniform size from about 30 to about 180nm, each of which is composed of many single magnetite crystallites approximately 10 nm in size.



Representative TEM Image of Magnetite CNCs of average diameter 31nm.



Mass Magnetization (M) as a function of applied magnetic field (H) for 93 nm CNCs at 300 deg. K.

ADVANTAGES

The benefits of the current approach are:

- ▶ The CNCs show superparamagnetic properties at room temperatures.
- ▶ High magnetization enabling ease of separation and targeted delivery in bio-medical applications.
- ▶ High water dispersability

SUGGESTED USES

- ▶ Targeted drug delivery

- ▶ Bio-separation
- ▶ Magnetic Resonance Imaging (MRI)
- ▶ Gas sensors
- ▶ Bio sensors
- ▶ Catalysts
- ▶ Catalyst support

RELATED MATERIALS

- ▶ [Superparamagnetic Magnetite Colloidal Nanocrystal Clusters](#)

RELATED TECHNOLOGIES

- ▶ [Stable Photonic Structures](#)

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