UNIVERSITY OF LEICESTER

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Novel Nanoparticles with Improved Magnetic Properties

Nanoparticles with unprecedentedly high magnetic moments, which are essential for developing future and emerging technologies.

Please note, header image is purely illustrative. Source: Aney, Wikimedia Commons, CCbySA3.0-cropped

IP Status

Patent application submitted

About **University of Leicester**

The University of Leicester works hand in hand with industry to generate business growth and find real applications for its leading innovation and research.

Background

An increase in the field strength of magnetic components in manufacturing processes and electronic devices may result in a reduction in energy consumption.

The performance of biomedical applications such as magnetic resonance imaging and hyperthermia treatment of cancer, strictly depend on the strength of magnetic nanoparticles.

There is a need to provide a cost-efficient method of manufacturing stronger magnets without increasing the physical size or weight of such materials.

Tech Overview

Researchers at the University of Leicester have developed novel nanoparticles with unprecedentedly high magnetic moments, which are essential for developing future and emerging technologies with improved energy efficiencies (Figure 1).

These high-moment magnetic nanoparticles have applications in biomedical science and the potential to form the building blocks of the next-generation magnets.

Further Details:

Yang et al., 2016 “Robust ferromagnetism of chromium nanoparticles formed in superfluid helium”, Adv. Mater. (2016) DOI: 10.1002/adma.201604277

Benefits

Commonly used bulk magnets made from single-phase materials consist of numerous small regions called magnetic domains, inside which the magnetic moments of atoms align in one direction. Different domains can have magnetic moments pointing in different directions, which dramatically reduces the overall magnetic moment. Consequently, conventional bulk magnets cannot provide a magnetic moment approaching the theoretical maximum.

A state-of-the-art concept is to use high-moment magnetic nanoparticles as the building blocks of bulk magnets. Novel magnetic materials with much improved energy efficiency are obtained when nanoparticles are grown with magnetic moments approaching theoretical maximum and then assembled with aligned magnetization at a high packing density.

Applications

Magnetic components are ubiquitous in electronic and electrical devices with applications extending from industry to household appliances, such as motors, power generators, wind turbines (green technology), loudspeakers and cell phones. Other possible applications include high-density data storage devices, components of quantum computers and spintronics, and biomedical applications including treatment and diagnosis.

The market potential for the applications of magnetic materials in the energy sector is vast. The world's total electricity generation was 20.2 trillion kWh in 2010 and is projected to be 26.6 trillion kWh in 2020.

Biomedical applications of magnetic nanoparticles have attracted much attention in recent years and has a huge market potential. The global market for nanoparticles in the life sciences is estimated at over $29.6 billion for 2014. This market is forecast to grow to more than $79.8 billion by 2019, to register a healthy compound annual growth rate (CAGR) of 22%.

Opportunity

Seeking co-development partners and/or a licensing opportunity to scale up the preparation high-moment magnetic nanoparticles and develop their applications in the construction of bulk magnets and biomedical treatment/diagnosis (MRI imaging and hyperthermia treatment of cancer).

Patents

- A GB priority patent application has been filed by the University of Leicester.

Appendix 1

Figure 1

Illustration of a nanomagnet (source: University of Leicester).