Multi-shell magnetic nanoparticles

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Electronics and semiconductors, Medical technology and devices

> TRL 4-6

Problem

Magnetic nanoparticles have a wide range of potential applications, such as biomedicine, electronics, and sustainable and renewable energy, because of their small size and attractive properties. However, reducing magnetic materials to nanoscale size negatively affects their magnetic properties which limits their use as well as presenting production challenges.

Solution

This technology is related to the design of and synthesis of nanoparticles with an alternating magnetic alloy multi-shell structure around a magnetic core.

The multi-shell structure confers the nanoparticles with enhanced magnetic properties such that they overcome current limitations of nanoscale magnetic materials. This retains ferromagnetism at room temperature and retain high magnetization and high coercivity at the nanoscale.

The refined synthesis method is key to realising the advantages of this technology. The size and shape of each magnetic phase, particularly shell thickness, is controlled and inter-phase contamination and side products are avoided. The method has been designed for industrial applications and is simple, reproducible, and affordable.

Intellectual Property Status

This IP is wholly Sydney-owned and is protected by International PCT patent application PCT/AU2022/051069.

Potential Commercial Applications

Through customising the shells, the nanoparticles' magnetic properties can be tailored to suit specific applications, for example magnetic hyperthermia (requiring moderate coercivity and magnetic moment), imaging contrast (requiring high magnetic moment and low coercivity), rare-earth-free permanent magnets (requiring high coercivity and magnetic moment), and data storage (requiring ferromagnetic nanoparticles at room temperature).

Other wide ranging potential applications include medical diagnostics and treatments, electrochemical sensing, catalyst support, wastewater treatment, environmental remediation.

The global market for magnetic nanoparticles was estimated to be worth between $33-44 million USD at the end of the last decade and is predicted to increase to between $87-$112 million USD around the middle of the current decade.

Inventors

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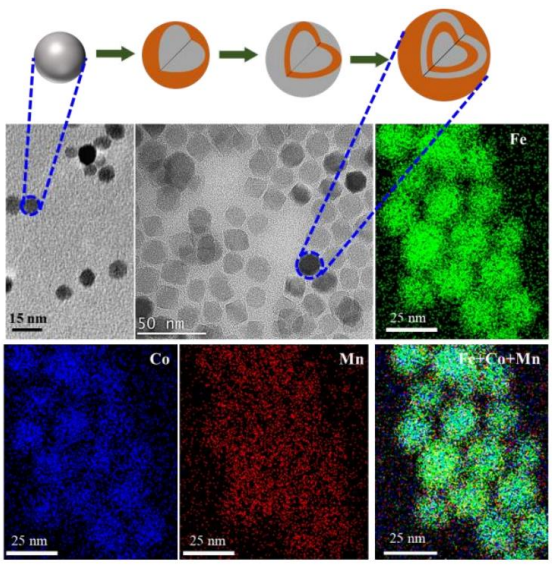

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