HETERO-ATOM INDUCED FERROMAGNETISM IN ANTIFERROMAGNETIC HEMATITE

IITM Technology Available for Licensing

Problem Statement

- **α-Fe2O3 (hematite)** is an antiferromagnetic material, limiting its applications in magnetic fields despite its attractive properties.
- By incorporating carbon-based materials or other magnetic substances, the antiferromagnetic nature of α-Fe2O3 can be overcome, making it suitable for various technological applications in magnetism.
- The present invention proposes a method by creating a **ferromagnetic composite for more efficient and less cumbersome** than existing techniques, providing a promising solution for improving α-Fe2O3's magnetic potential.

Technology Category/ Market

Category - Advanced Material & Manufacturing
Applications - Nanobiosensors, batteries or giant magnetoresistance devices, data storage
Industry - Electronics, Materials Science Biomedical Engineering, Energy Storage Industry

Market - The global magnetic materials market is valued at USD 88.94 Billion in 2020 and expected to reach USD 164.68 Billion by 2027 with a CAGR of 9.2%.

Key Features / Value Proposition

1. The resulting ferromagnetic hematite iron oxide has a rhombohedral crystal structure with specific oxygen and iron site defects, leading to **magnetization of 7emu/g or greater**.
2. The oxygen occupancy at 18e site ranges from 1 to 0.499, and the iron occupancy at 12c site ranges from 1.005 to 0.978.
3. The **magnetization achieved is between 7-17 emu/g.**
4. The synthesized α-Fe2O3 has application in nanomagnetic devices, nanobiosensors, batteries, and magnetic field controlled photocatalytic reactors and biomedical applications.
5. Potential use in targeted **drug delivery, MRI, and magnetic separation techniques**.

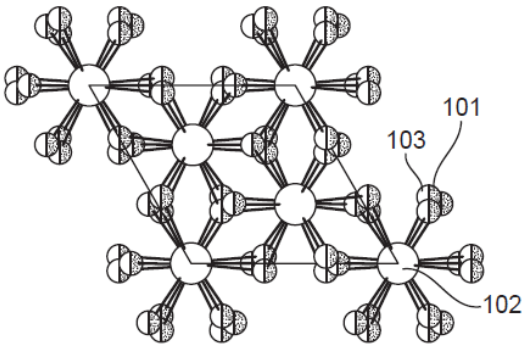

FIG. 1 illustrates ferromagnetic hematite iron oxide crystal structure.

Intellectual Property

- IITM IDF Ref. **1765**
- **IN 201841038764**
- **PCT/IN2019/050751 - Published**

Technology

- The invention presents **a single-step method for synthesizing ferromagnetic hematite iron oxide (α-Fe2O3) using either combustion or pyrolysis techniques**.(Fig.1)
- For combustion synthesis, a composite admixture containing iron precursor(s) and heteroatom precursor(s) is heated to a predetermined temperature range of **temperature range of 300 °C to 600 °C** under an inert gas atmosphere. Subsequently, the admixture is exposed to atmospheric air.
- For pyrolytic synthesis, the same type of composite admixture is heated under an air atmosphere within a specific temperature range. The **heat treatment duration is 2 to 3 hours.**
- The method induces ferromagnetism by incorporating heteroatoms, possibly in the sites of crystal defects in α-Fe2O3, **resulting in a high yield of magnetic α-Fe2O3 with strong magnetization**.

TRL (Technology Readiness Level)

TRL - 4, Technology validated in lab.

Research Lab

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