Review on SmFeO3 prepared by different synthesis techniques

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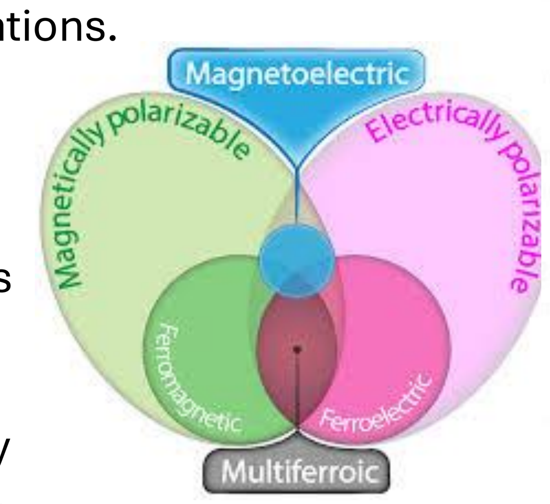
Abstract

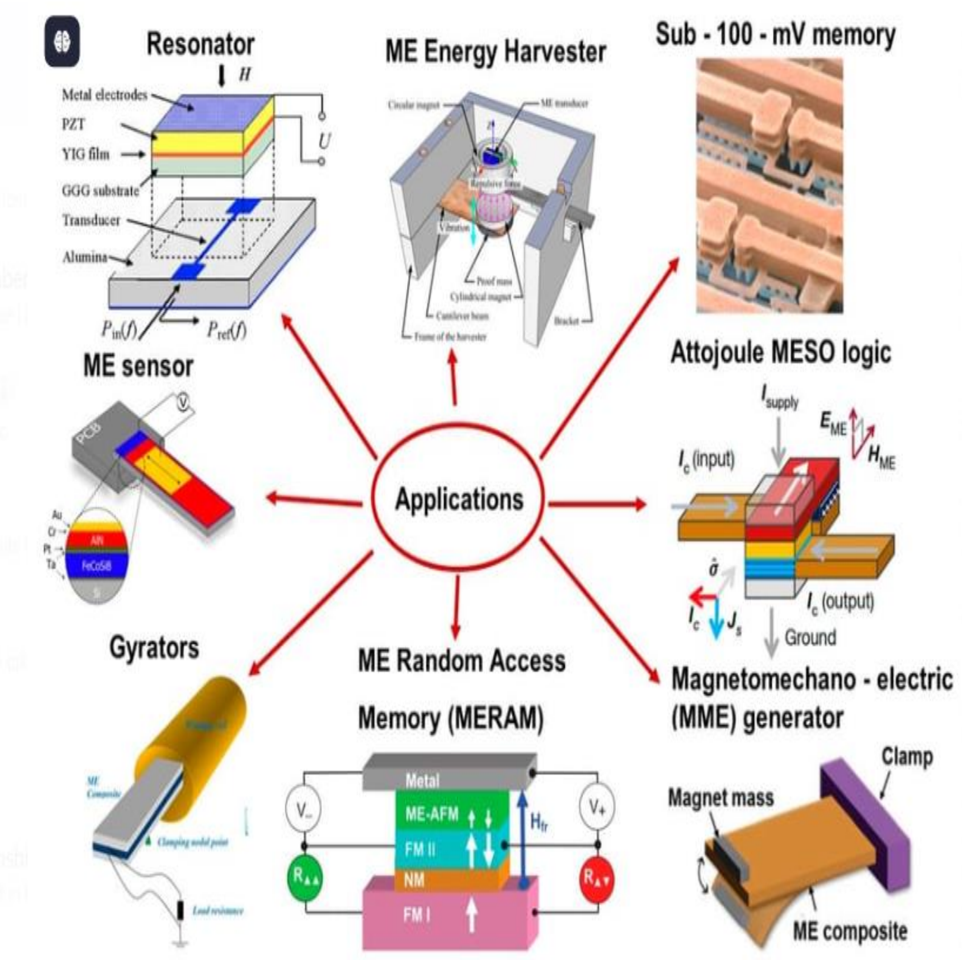
Samarium Orthoferrite (SmFeO3) is an orthorhombic perovskite structured material with significant applications in the area of magnetic sensors & energy storage The synthesis method plays crucial role for determining the structural, morphological and magnetic properties This review compares three widely used synthesis techniques ; sol-gel method, solid-state reaction and ball-milling method The relative effect of these method on structure of the compound and its various properties have been investigated through the vast literature review for instance, influence of the method on the sizes of the nanostructures have been found to be 46nm for the sample prepared by sol-gel method whereas, solid-state reaction method results in 63 nm similarly ball-milling method provides a top-down approach for size reduction & strain – induced defect. Thus, a comparative analysis of these material reveal variation in optical bandgaps, structured integrity & functional properties of SmFeO3
Keywords: SmFeO3, Sol-gel method, Solid-state reaction and Ball-milling method

Introduction

Samarium Orthoferrite (SmFeO3) is a perovskite structure its general formula is ABX3 or ABO3. Its used in widely applications.

1. Resonator
2. ME Energy
3. Gyrators
4. ME Random Across memory
5. ME sensor
6. Sub-10 mv memory
7. Magnetomechano-electric (MME) generator
8. Attojoule MESO logic

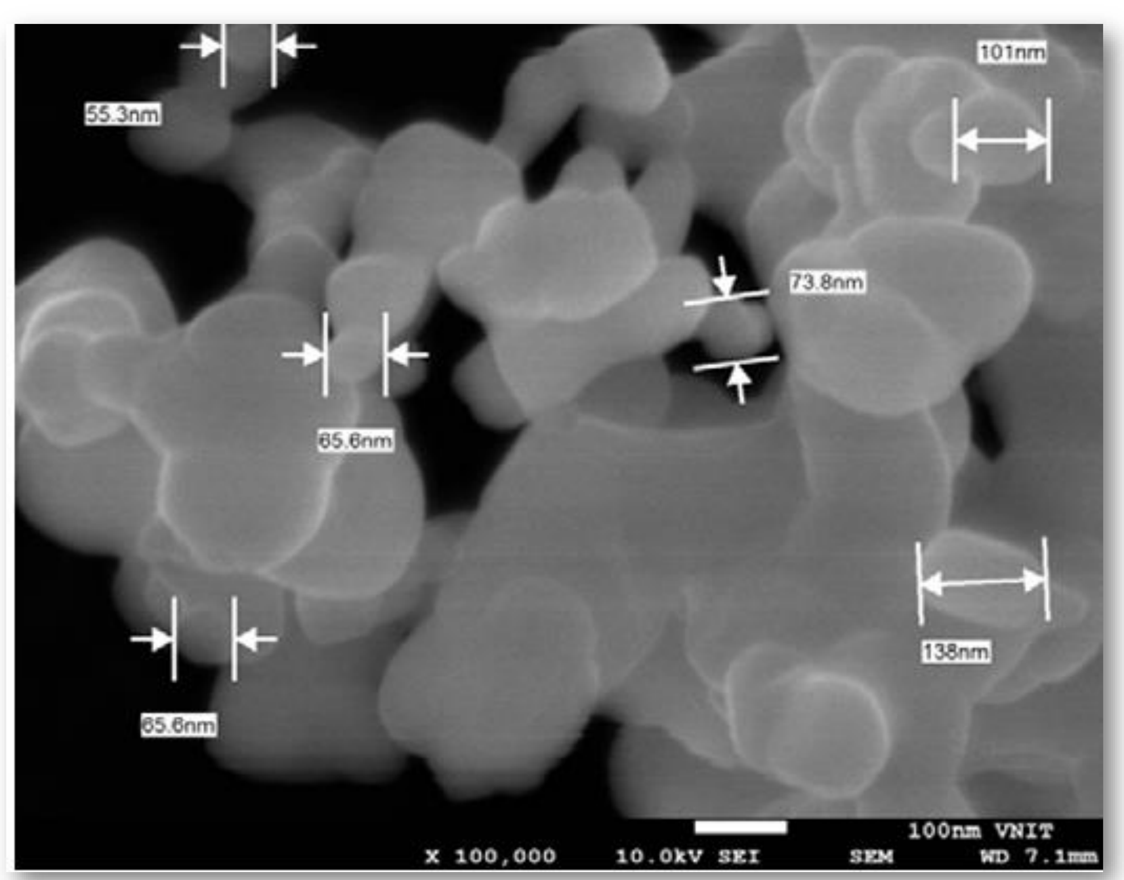




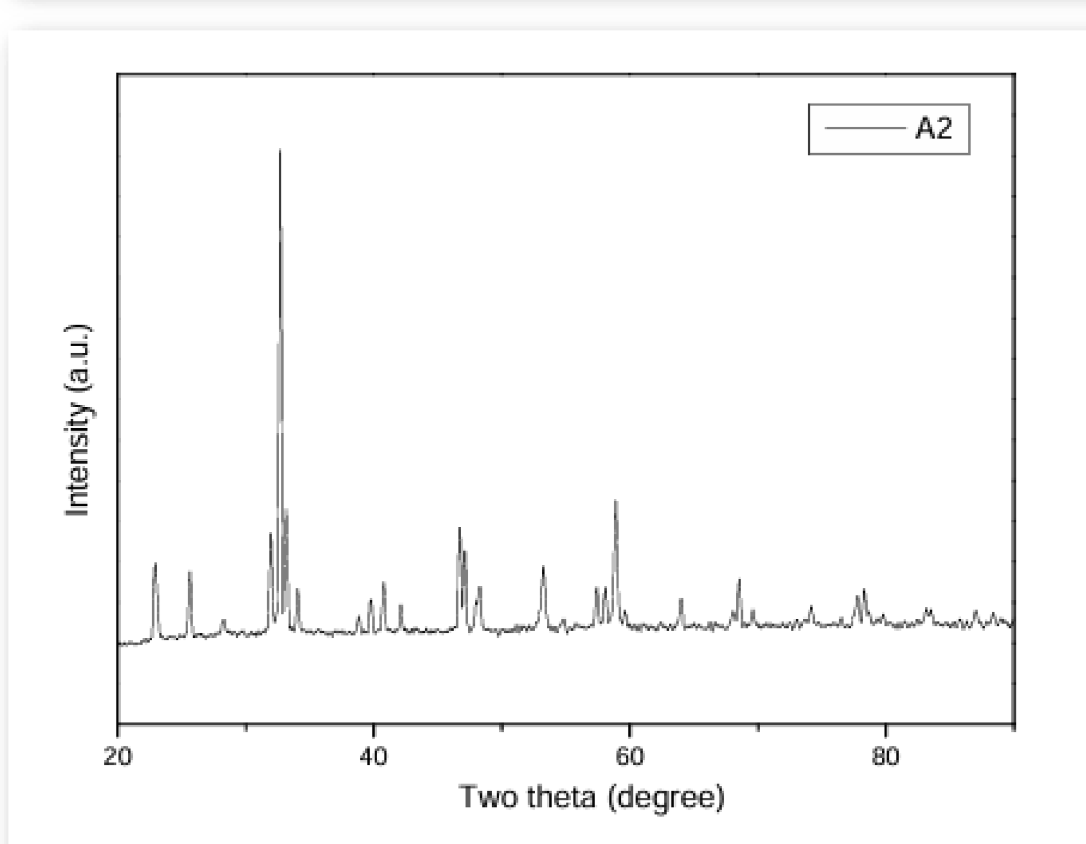
And its many properties such as multiferroic, catalyst , gas sensors etc.

Literature Review

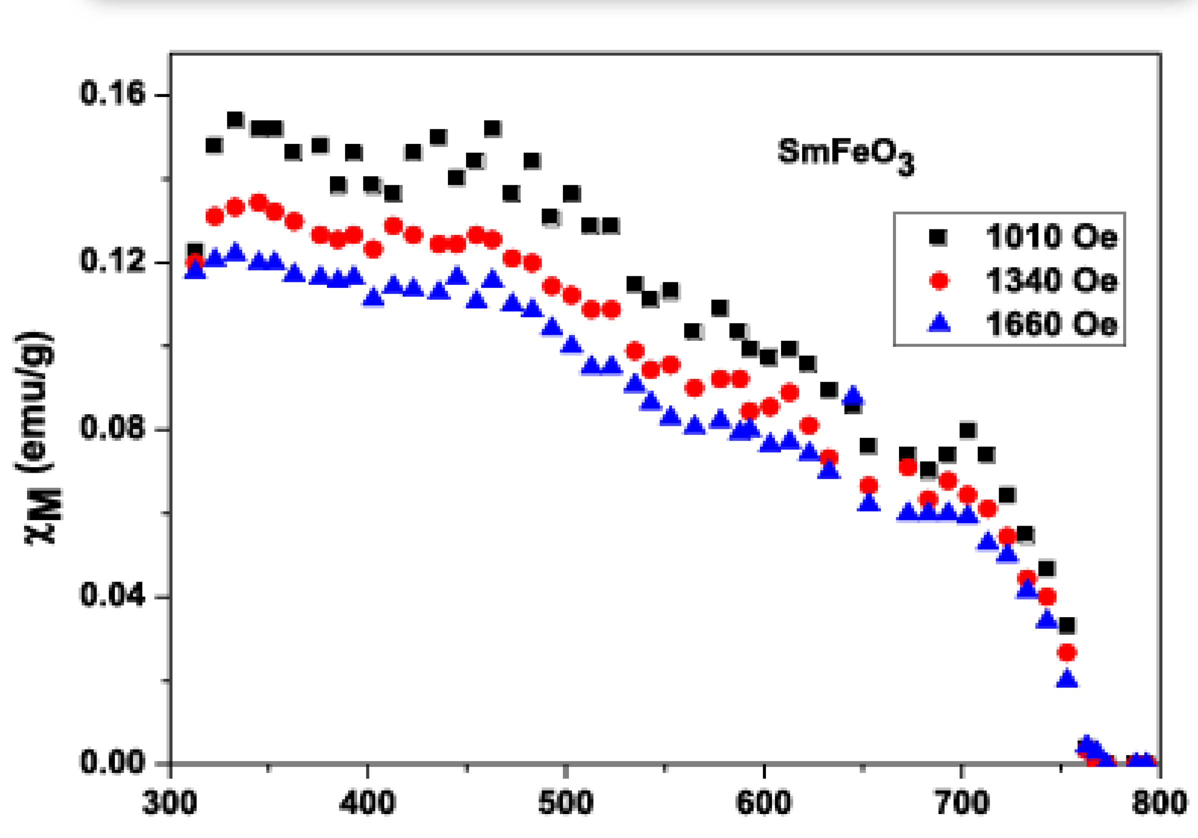
- SEM indicates the particle size are irregular until it average size is 100 nm
- Sol-gel method has 46nm crystalline size due to lower-reaction temperature meanwhile, solid-state reaction has 63 nm crystallite size due to prolonged diffusion & grain growth.



- XRD pattern indicates the single phase orthorhombic structure with confirms that the belong to space group Pnma
- The relative intensity of the XRD pattern is observed as milling time increases which might indicate the decreases in crystal size



- The relationship between Xm and the absolute temperature at different magnetic field strength for SmFeO3 nanoparticles
- Xm values rise with increasing temperature until Tsr = 463K when they begin to fall slowly until they reach the Neel temperature (Tn)
- After Neel temperature, sample loses its anti-ferromagnetic properties and begin exhibit paramagnetic behaviour



Different synthesis techniques

Samarium orthoferrite((SmFeO3) has rare-earth orthoferrite that has gain significant attention due to its unique structural, magnetic & optical properties It belongs to the perovskite family (RFeO3 where, R = rare earth metal)

The perovskite SmFeO3 are highly dependent on its synthesis techniques as different methods influence the particle size, crystallinity& morphology

Various synthesis techniques including sol-gel method, solid – state reaction and ball- milling method have been employed to optimize physical & chemical properties.

Each technique offers distinct advantages in terms of phase-purity, size reduction and magnetic properties

This review provides in-depth comparison of different synthesis techniques highlighting the effect of structural, optical and magnetic properties

Conclusion

- XRD pattern indicate that orthorhombic structure or Pnma (or space group)
- Ball- milling method , might time increases with decreases crystallite size
- By sol- gel method crystallite size in 46nm while, solid – state reaction in crystallite size in 63 nm because the sol-gel method has lower reaction temperature while, solid- state reaction due to prolonged diffusion & grain growth .
- Magnetic ordering of Smfeo3 phases changes from anti-ferromagnetic to ferromagnetic due to thermal disorder.

References

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