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Srinivas Research Centre for Synthesis and Characterization of ultrafine spinels



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About the Research Centre:

Magnetisation and magnetic materials have been an integral part of human life from time immemorial. Ferrites are weak ferromagnetic or ferrimagnetic materials with iron as one of the components. The structural, magnetic and electrical properties of these compounds are governed critically by their chemical composition. Hence preparation of these ferrites with specific properties has gained much importance.

Ferrites can be prepared by conventional solid state methods and numerous chemical routes, such as reverse micelle synthesis, coprecipitation, thermal decomposition, solgel and aerogel process. The high energy ball milling is an excellent tool to produce fine particle materials with a wide range of particle sizes.

Ferrites and materials derived from ferrites find extensive application in devices like transformers, TV Yokes, loud speakers and in many other devices. They are also one of the largely used material medium for audio/video applications and computer memories and switches. At microwave frequencies, it is used in various polarization rotators, resonance isolators and phase shifters.

A comparison of structural parameters of ferrites and aluminates reveal that aluminate is a relatively stable compound and ball milling does not induce any decomposition. On the other hand, ferrite upon ball milling may subject to decompose.

One of the reasons for the anomaly exhibited by ferrite samples could be cation redistribution and subsequent emergence of ferrimagnetic ordering in these systems and bond breakage at the surface and emergence of surface spin disorder. FC-ZFC ac magnetic susceptibility studies confirmed the presence of a superparamagnetic component in fine particle ferrite. Mossbauer

spectroscopy on selected samples of milled and unmilled ferrites at room temperature and low temperatures reveal that the spectrum consists of tell tale signatures of a typical ferrimagnetic ordering together with signs of a superparamagnetic component. Temperature dependence of dielectric permittivity confirms the belief that holes are the majority charge carriers in the transport process.

Milling does not produce noticeable effects on the dc conductivity and dielectric permittivity of aluminates.

Objectives of Srinivas Research Centre for Synthesis and Characterization of ultrafine spinels are

- * Synthesis of different ferrite materials using coprecipitation method.
- * Synthesis of different aluminate materials using coprecipitation method.
- * Characterization by different tools.
- * Envisaging a structure in ultrafine regime for the synthesized materials based on the characterization result.
- * Correlating the anomaly with new theories.

List of publications so far:-

1. *Effect of mechanical milling on the Structural, Magnetic and Dielectric properties of coprecipitated ultrafine zinc ferrite*, **S.D. Shenoy**, P.A.Joy, M.R.Anantharaman, Journal of Magnetism and Magnetic Materials 269 (2004) p217
2. *Structural and magnetic properties of ultrafine particles of zinc ferrite*, **Santhosh D. Shenoy**, P.A.Joy, Ajay Gupta and M.R.Anantharaman, Proceedings of 45th DAE Solid State Physics Symposium - 2002 held at Punjab University, Chandigarh during December 26-30, 2002 p 505
3. *Cation redistribution in ultrafine zinc ferrite subjected to high energy ball milling* **Santhosh D. Shenoy**, P.A.Joy, Alok Banerjee and M.R.Anantharaman presented in the international conference on materials for advanced technologies-2003 (ICMAT 2003) held at Singapore during 7-12 December 2003

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