How to make Ferrites become Ferromagnetic

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Nanotechnology and nanoscience are considered to be the rapid emerging fields for the last two decades. They have unique, unusual, unexpected, unimaginable and superior properties compared to bulk counterparts. Due to their unique properties, the physical and chemical properties were extensively investigated both experimentally and theoretically. At nanoscale, the quantum size effects are strongly influenced by core and surface area. Knowing that, one can manipulate to grow artificial materials with the controlled properties using different chemical compositions.

The unexpected magnetism in few materials is due to nanosize. When the dimension of the material is reduced, it results in the reduction of co-ordination number of atoms which in turn reduces the electrons hopping from one site to another site. Therefore, the bandwidth reduces and increases the Coulomb interaction. This results in the tendency of electrons to enhance in making the magnetism to appear at nanoscale. Moreover, defects due to additives may create vacancies in the magnetic material which also plays important role in inducing collective magnetic properties at nanoscale.

I will talk in details about three cases: $ZnFe_2O_4$, $BiFeO_3$, and $BaFeO_3$. We somehow have achieved to manipulate those ferrites in order to tailor their magnetic properties to fit our expectation of applications. In general, there are ways to suppress the spiral magnetic ordering by applying a very high magnetic field, by creating epitaxial constrains, or reducing the dimensions of the sample, or by chemical substitution of Bi^{3+}or Fe^{3+} by other ions of comparable ionic sizes. Reduction in dimension is certainly shown to enhance the magnetization in thin films and in nanoparticles