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## Transition metal oxide nanostructures and their novel properties

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Iron and other transition metal oxides nanostructures receive considerable attention due to their extensive technological applications in high density magnetic storage media, high frequency devices, magnetically assisted drug delivery, cell isolation, MRI contrast agents, immobilization of proteins and enzymes, biosensors and so on. We observed many novel and enhanced properties in those oxides depending on their shapes and sizes. They can be functionalized with suitable ligands to get biocompatible and water-soluble nanostructures with interesting multifunctional properties. For example, intrinsic multicolor fluorescence in $MnFe_2O_4$ nanoparticles (NPs)/hollow spheres (NHSs) from blue, cyan, and green to red is observed upon functionalization with a small organic ligand such as Na-tartrate because of ligand-to-metal charge transfer from tartrate ligand to lowest unoccupied energy level of $Mn^{2}+/^{3}+$or $Fe^{3}+$ of the NPs and Jahn-Teller distorted d-d transitions centered over $Mn^{3+}$ ions in the Nanostructures. $CoFe_2O_4$ nanoparticles functionalized with surfactants having π-acceptor/π-donor head group along with different chain-length show much higher coercivity compared to bare particles due to NP-ligand interaction which modifies the splitting of d-orbital energy levels as well as spin motion of surface $Co^{+2}$ ions. Many of the above oxide nanostructures show excellent photocatalytic activities and potential for various biomedical applications depending on their shape, size and surface functionalizations.

**Recent Publications**

1. R Rakshit, M Mandal, M Pal, K Mandal (2014) Tuning of magnetic properties of $CoFe_2O_4$ nanoparticles through charge transfer effect. *Applied Physics Letters;* 104(9): 092412.
2. M Pal, R Rakshit, K Mandal (2014) Surface Modification of $MnFe_2O_4$ Nanoparticles to Impart Intrinsic Multiple Fluorescence and Novel Photocatalytic Properties. *ACS Applied Materials and Interfaces*; 6(7): 4903-4910.

## Biography

Kalyan Mandal is a Senior Professor in S N Bose National Centre for Basic Sciences, Kolkata, India, mainly works on magnetism and magnetic materials including magnetic nanomaterials. He has received his PhD degree from the Indian Institute of Technology Kharagpur, India and performed his Postdoctoral Research in Queen's University, Canada and Institute de Magnetismo Aplicado, Madrid, Spain. He has received Humboldt Fellowship from Germany and worked in IFW-Dresden and other universities/institutes in Germany as a Humboldt Fellow. He has received UK-India Education and Research Initiative Award to work in Durham University, UK. He has also worked in Osaka University, Japan as a Visiting Professor and received Materials Research Society of India Award in 2016.

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