**Electronic Supporting Information on**

# Role of $Mg^{2+}$ and $In^{3+}$ substitution on magnetic, magnetostrictive and dielectric properties of $NiFe_2O_4$ ceramics derived from nanopowders

P. N. Anantharamaiah [a,*], B. Prerna Rao [b], H. M. Shashanka[a], J. A. Chelvane[c] , V. Khopkar[d], B. Sahoo[d,*]

[a]*Department of Chemistry, Faculty of Mathematical and Physical Sciences, M. S. Ramaiah University of Applied Sciences, Bangalore 560058, India*
[b]*Department of Physics, Faculty of Mathematical and Physical Sciences, M. S. Ramaiah University of Applied Sciences, Bangalore 560058, India*
[c]*Advanced Magnetic Group, Defence Metallurgical Research Laboratory, Kanchanbagh, Hyderabad, 500058, India*
[d]*Materials Research Centre, Indian Institute of Science, Bangalore 560012, India*

**Table S1**. Ionic size of the different metal ions.

| Ion | Ionic radii (Å) | |
|---|---|---|
| | 4-fold environment | 6-fold environment |
| $Mg^{2+}$ | 0.57 | 0.72 |
| $Fe^{3+}$ | 0.49 | 0.645 |
| $In^{3+}$ | 0.62 | 0.80 |

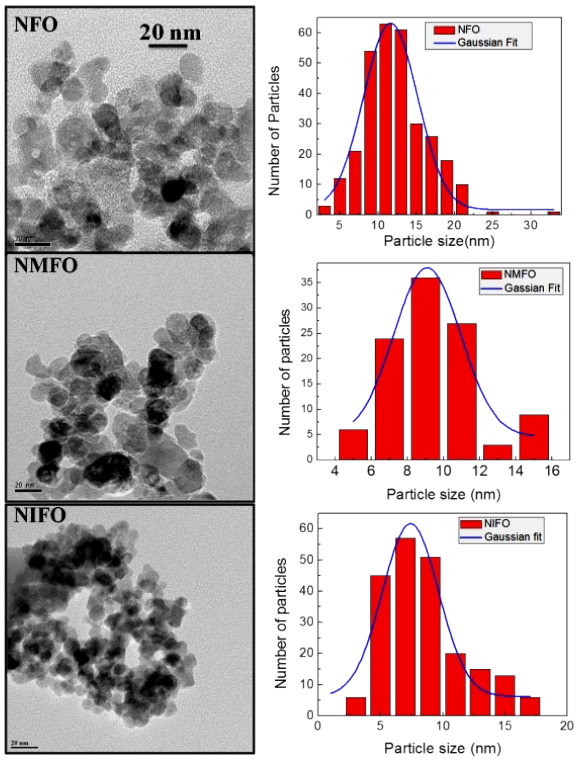


**Fig. S1**. TEM images and the corresponding particle size distribution histograms of NFO, NIFO and NMFO samples, calcined at 500 °C for 2 hours. Note that the size distribution is obtained by considering many TEM micrographs.

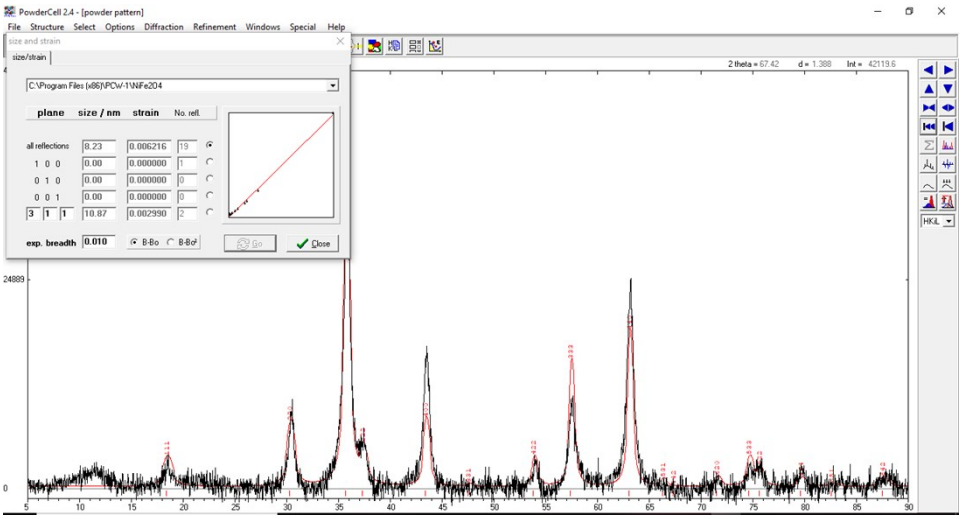


**Fig. S2**. Fitted XRD pattern of the calcined NFO sample, using PCW (powder cell for windows).

**Table S2**: Rietveld fitting parameters, lattice parameter and theoretical density of sintered $NiFe_2O_4$ $NiFe_{1.8}In_{0.2}O_4$ and $NiFe_{1.8}Mg_{0.2}O_4$.

| Sample | a (Å) | $R_p$ (%) | $R_{wp}$ (%) | $\chi^2$ | 'a' (Å) | $D_{theor.}$(g/cm$^3$) |
|---|---|---|---|---|---|---|
| $NiFe_2O_4$ | 8.3395 | 1.25 | 1.6 | 2.60 | 8.3395 | 5.36 |
| $NiFe_{1.8}In_{0.2}O_4$ | 8.3739 | 1.5 | 2.0 | 3.36 | 8.3739 | 5.56 |
| $NiFe_{1.8}Mg_{0.2}O_4$ | 8.3469 | 1.3 | 1.8 | 3.23 | 8.3469 | 5.46 |

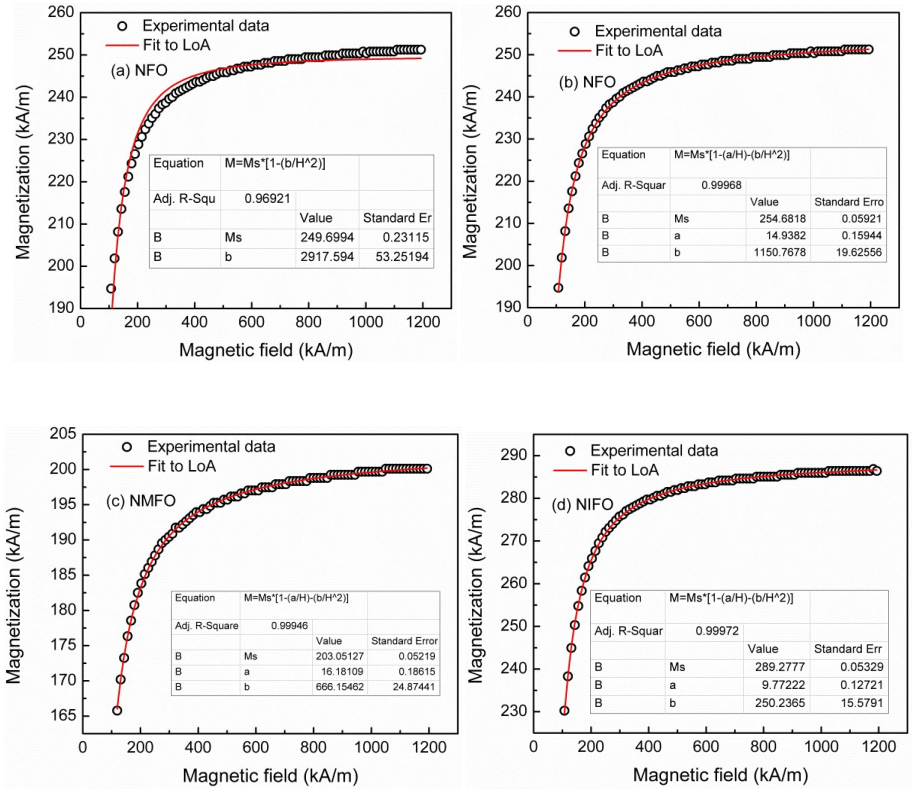


**Fig. S3**: Fit to the initial magnetization curves using the law of approach to saturation method.