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## Research articles

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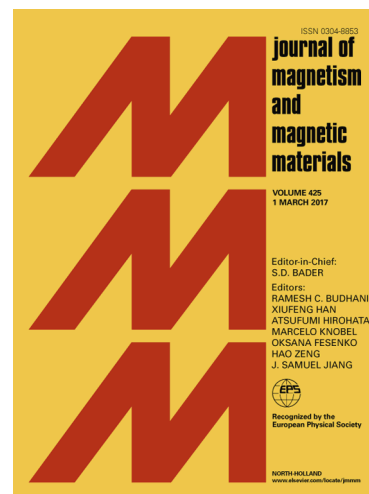
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# Enhanced room temperature multiferroic characteristics in hexagonal $\text{LuFe}_{1-x}\text{Ni}_x\text{O}_3$ ( $x = 0 - 0.3$ ) nanoparticles

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## Abstract

Single phase polycrystalline  $\text{LuFe}_{1-x}\text{Ni}_x\text{O}_3$  ( $x = 0 - 0.3$ ) (LFNO) nanoparticles are synthesized using the sol-gel method. X-ray diffraction measurements revealed that the crystal structure of Ni-doped samples is isomorphic to hexagonal  $\text{LuFeO}_3$  (LFO). The phase pure hexagonal  $P6_3cm$  symmetry exists for  $0 \leq x \leq 0.3$ , and the secondary phases appear for  $x \geq 0.4$ . Raman spectra show a shift in the mode frequency corresponding to the changes in Lu-O and Fe-O bond lengths with Ni doping. An enhancement in the magnetization is observed for LFNO throughout the temperature range (400 K – 5 K) compared to LFO. The antiferromagnetic state of LFO becomes ferrimagnetic at low temperatures, and a net magnetization is observed at room temperature with Ni doping. As Ni concentration increases, a systematic increment in the ferroelectric polarization is observed. This enhancement in polarization is believed to be due to the distortion in  $\text{FeO}_5$  cage, while the improvement in magnetic properties is due to the induced magnetic interactions, caused by the Fe-Ni interactions on the triangular lattice with Ni doping in  $\text{LuFeO}_3$ .

**Keywords:** magnetic nanoparticles, hexagonal ferrites, Raman spectra, hexagonal ferroelectricity, multiferroics.

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