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Ferroic ordering and charge-spin-lattice order coupling in Gd doped Fe_3O_4 nanoparticles SUVRA LAHA, EHAB ABDELHAMID, MAHESHIKA PALIHAWADANA ARACHCHIGE, Wayne State University, AMBESH DIXIT, Indian Institute of Technolgy Jodhpur, GAVIN LAWES, Wayne State University, VAMAN NAIK, University of Michigan Dearborn, RATNA NAIK, Wayne State University — Rare earth doped spinels have been extensively studied for their potential applications in magneto-optical recording and as MRI contrast agents. In the present study, we have investigated the effect of gadolinium doping (1-5 at.%) on the magnetic and dielectric properties of Fe_3O_4 nanoparticles synthesized by the chemical co-precipitation method. The structure and morphology of the as-synthesized gadolinium doped Fe_3O_4 (Gd-Fe_3O_4) nanoparticles were characterized by XRD, SEM and TEM, and the magnetic properties were measured by a Quantum Design physical property measurement system. We find that the penetration of excess Gd^{3+} ions into Fe_3O_4 spinel matrix significantly influences the average crystallite size and saturation magnetization in Gd-Fe_3O_4. The average crystallite size, estimated from XRD using Scherrer equation, increases with increasing Gd doping percentage and the saturation magnetization drops monotonically with excess Gd^{3+} ions. Interestingly, Gd- Fe_3O_4 develops enhanced ferroelectric ordering at low temperatures. The details of the temperature dependent dielectric, ferroelectric and magnetocapacitance measurements to understand the onset of charge-spin-lattice coupling in Gd-Fe_3O_4 system will be presented.

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