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| Title | Observation of room temperature multiferroic and electrical properties in gadolinium ferrite nanoparticles | | |
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| Abstract: The formation and characterization of multiferroic Gadolinium Ferrite (GdFeO3) nanoparticles has been demonstrated in detail. The structural, magnetic, magnetodielectric, ferroelectric, optical and electrical properties are studied at different temperature ranges. Dielectric properties, DC and AC transport properties and dielectric relaxation behavior are analyzed in electrical characterization. XRD pattern confirms the phase formation where crystallite size, lattice strain, etc. are carried out by Rietveld refinement and Williamson–Hall plot. Average particle size is 64 nm, which is calculated from TEM image. Mixed ferroic order of ferromagnetism and antiferromagnetism along with exchange bias are detected in the nanoparticles. Ferroelectric nature of the sample is confirmed by the P-E hysteresis loops. Positive magnetodielectric coupling is observed in GdFeO3 nanoparticles, which is a signature of multifunctionality nature. Charge transport mechanism of DC and AC applied electric field is successfully analyzed with Mott’s variable range hopping (VRH) and correlated barrier hopping (CBH) theoretical models, respectively. Non-Debye type relaxation behavior is observed with activation energy of 0.37 eV. Optical band gap is calculated from the Tauc plot (2.98 eV) which confirms the semiconducting nature of the sample. Existence of ferromagnetic/antiferromagnetic (FM/AFM) and ferroelectric along with magnetodielctric coupling ensures the multiferroic property of GdFeO3 nanoparticles, which may enhance potentiality in spintronic device applications. |  |
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