Title:	Phase engineered gallium ferrite:
Other Titles:	a promising narrow bandgap, room-temperature ferroelectric
Authors:	Sanwlani, Shilpa (/jspui/browse?type=author&value=Sanwlani%2C+Shilpa)
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Abstract:	Narrow bandgap oxide ferroelectrics with large polarization are considered promising in novel optoelectronic and photovoltaic devices. In the present work, nanocrystalline gallium ferrite with polar, rhombohedral R3c symmetry is synthesized using the hydrothermal route. Structural characterization using X-ray diffraction, Raman spectroscopy, and electron microscopy confirm the formation of the rhombohedral R3c phase, with two different geometries and narrow size distribution. Electrical characterization corroborated by first-principles density functional theory-based calculations demonstrates room temperature ferroelectricity contributed mainly by triply charged gallium ions. The calculated spontaneous polarization is ∼20 μC cm−2 with a large electronic contribution. Optical characterization predicts a bandgap of ∼2.1 eV. Together with its narrow bandgap and the large contribution of electronic polarization, ferroelectric gallium ferrite could be an interesting system for novel photovoltaic and optoelectronic devices.
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