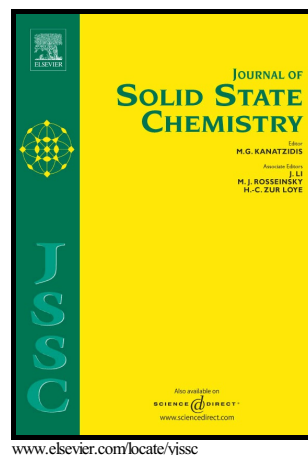


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PII: S0022-4596(18)30215-9
DOI: <https://doi.org/10.1016/j.jssc.2018.05.027>
Reference: YJSSC20233

To appear in: *Journal of Solid State Chemistry*

Received date: 21 March 2018

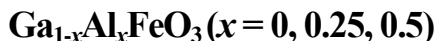
Revised date: 17 May 2018

Accepted date: 18 May 2018

Cite this article as: Pavitra N. Shanbhag, T. Thao Tran, P. Shiv Halasyamani, A. Sundaresan and C.N.R. Rao, High Pressure Synthesis and Magnetic Properties of Corundum-type $\text{Ga}_{1-x}\text{Al}_x\text{FeO}_3$ ($x = 0, 0.25, 0.5$), *Journal of Solid State Chemistry*, <https://doi.org/10.1016/j.jssc.2018.05.027>

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High Pressure Synthesis and Magnetic Properties of Corundum-type



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Abstract

Metastable phases of $\text{Ga}_{1-x}\text{Al}_x\text{FeO}_3$ ($x = 0, 0.25, 0.5$) have been prepared under high pressure (4.5 GPa) and high temperature (1000 °C) using a cubic-anvil high pressure apparatus. X-ray diffraction studies show that application of pressure transforms the structure of these compounds from the polar $Pna2_1$ to the non-polar $R\bar{3}c$ phase. Intriguingly, the orthorhombic phases of the compounds with $x = 1.0$, synthesized at ambient pressure decompose into their constituent oxides, Al_2O_3 ($R\bar{3}c$) and Fe_2O_3 ($R\bar{3}c$) under the same conditions of pressure and temperature. Magnetization measurements reveal antiferromagnetic ordering with a weak ferromagnetism below $T_N \sim 450$ K, 590 K and 650 K, respectively. All these oxides exhibit a spin glass behavior at low temperatures. Analysis of ac susceptibility measurements indicate the existence of a cluster spin glass phase below $T^* \sim 45, 40$ and 43 K respectively for $x = 0, 0.25, 0.5$. Such a re-entrant spin glass behavior arises due to antiferromagnetic interactions among the disordered Fe^{3+} ions in the octahedral site of the corundum structure.

Keywords: Oxides; High pressure synthesis; spin glass; crystal structure

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