

Accepted Manuscript

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PII: S0925-8388(17)30081-6

DOI: [10.1016/j.jallcom.2017.01.061](https://doi.org/10.1016/j.jallcom.2017.01.061)

Reference: JALCOM 40428

To appear in: *Journal of Alloys and Compounds*

Received Date: 26 October 2016

Revised Date: 4 January 2017

Accepted Date: 6 January 2017

Please cite this article as: V.R. Monaji, S. Indla, S. Rayaprol, S. Sowmya, A. Srinivas, D. Das, Temperature dependent magnetic properties of $\text{Co}_{1+x}\text{T}_x\text{Fe}_{2-2x}\text{O}_4$ (T = Zr, Ti), *Journal of Alloys and Compounds* (2017), doi: 10.1016/j.jallcom.2017.01.061.

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Temperature dependent magnetic properties of $\text{Co}_{1+x}\text{T}_x\text{Fe}_{2-2x}\text{O}_4$ (T = Zr, Ti)

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Abstract

This study demonstrates the temperature dependent (carried out at 5, 150 and 300 K) magnetic properties of Zr^{4+} and Ti^{4+} substituted cobalt ferrite samples and their comparison. Polycrystalline $\text{Co}_{1+x}\text{T}_x\text{Fe}_{2-2x}\text{O}_4$ ($0 \leq x \leq 0.4$ and T = Zr, Ti) series of compositions were prepared by conventional ceramic method. X-ray diffraction (XRD) confirmed the single phase cubic spinel structure, except for $x = 0.4$ composition. Coercivity (H_c) is observed to increase substantially with decrease in temperature for all Zr and Ti substituted samples. The magnetization and magnetocrystalline anisotropy constant (K_1) were observed to peak at ~150K for both the series of samples. Field sensitivity of magnetization (dM/dH) increased with progressive Zr and Ti substitutions. Curie temperature of $\text{Co}_{1.2}\text{Zr}_{0.2}\text{Fe}_{1.6}\text{O}_4$ and $\text{Co}_{1.2}\text{Ti}_{0.2}\text{Fe}_{1.6}\text{O}_4$ samples (~ 445°C and 472°C respectively) decreased compared to that of pure cobalt ferrite (~517°C).

Key words: Oxide materials; Cobalt ferrite; Magnetic properties; Exchange interaction; Magnetocrystalline anisotropy; Magnetization.

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