

Author's Accepted Manuscript

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www.elsevier.com/locate/ceri

PII: S0272-8842(18)30572-8
DOI: <https://doi.org/10.1016/j.ceramint.2018.03.024>
Reference: CERI17661

To appear in: *Ceramics International*

Received date: 30 December 2017
Revised date: 1 March 2018
Accepted date: 4 March 2018

Cite this article as: Muhammad Younis, Murtaza Saleem, Shahid Atiq and Shahzad Naseem, Magnetic phase transition and magneto-dielectric analysis of spinel chromites: $M\text{Cr}_2\text{O}_4$ (M = Fe, Co and Ni), *Ceramics International*, <https://doi.org/10.1016/j.ceramint.2018.03.024>

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Magnetic phase transition and magneto-dielectric analysis of spinel chromites: MCr_2O_4 (M = Fe, Co and Ni)

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Abstract

In this work, we present magnetic phase transition temperatures and magneto-dielectric coupling in MCr_2O_4 (M = Fe, Co and Ni) ceramics, synthesized using sol-gel auto-combustion route. In order to develop their respective crystalline textures, all these chromites were calcined at 650°C for 2 h. X-ray diffraction patterns confirmed that FeCr_2O_4 had a rhombohedral structure while NiCr_2O_4 and CoCr_2O_4 exhibited a spinel-type cubic structure. The presence of relevant elements in the specific stoichiometric ratios was confirmed using energy dispersive X-ray spectroscopy. The shapes and sizes of the grains for all the samples were determined using the images obtained from a field emission scanning electron microscope. Temperature dependent magnetic analysis have shown that FeCr_2O_4 , CoCr_2O_4 and NiCr_2O_4 are ferromagnetic at 5K and their magnetic phase transition temperatures were measured as 80, 83 and 90K, respectively. Spin-orbit interference was also studied through magneto-dielectric coupling for these chromites using a modified impedance analyzer set-up.

Keywords: Chromites; Magnetic phase transition; Magneto-dielectric coupling

1. Introduction

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