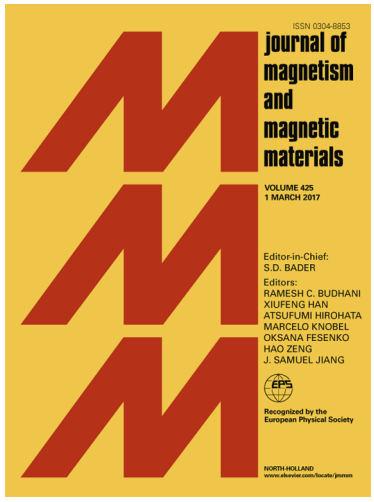

Study of exchange bias and memory effect in core-shell $CoCr_2O_4$ nanoparticles

G. Jagadish Kumar, Chandana Rath

PII: S0304-8853(18)30649-8
DOI: https://doi.org/10.1016/j.jmmm.2018.06.080
Reference: MAGMA 64100

To appear in: *Journal of Magnetism and Magnetic Materials*

Received Date: 6 March 2018
Revised Date: 31 May 2018
Accepted Date: 27 June 2018

Please cite this article as: G. Jagadish Kumar, C. Rath, Study of exchange bias and memory effect in core-shell $CoCr_2O_4$ nanoparticles, *Journal of Magnetism and Magnetic Materials* (2018), doi: https://doi.org/10.1016/j.jmmm.2018.06.080

Study of exchange bias and memory effect in core-shell $CoCr_2O_4$ nanoparticles

G. Jagadish Kumar [1] and Chandana Rath[1*]

[1] School of Materials Science and Technology, Indian Institute of Technology (BHU), Varanasi, India, 221005.

[*]Corresponding author. E-mail address: chandanarath@yahoo.com

Abstract

$CoCr_2O_4$ of 50 nm particles having core-shell structure demonstrate two different phenomena such as memory effect and exchange bias depending on temperature. The memory effect is responsible for spin glass behavior in the shell and exchange bias is due to core-shell interactions. From magnetization measurement, we observe a long range ferrimagnetic (**FiM**) order in core, the spin glass behavior at the shell. The spin glass nature is confirmed from memory effect experiment performed using zero field cool (ZFC) protocol below blocking temperature (T_B) i.e. 80 K. While the strength of memory effect decreases with decrease in temperature and vanishes at 30 K, the exchange bias increases with decrease in temperature down to 50 K and shows 2 orders of magnitude more than the bulk at lowest temperature. The high exchange bias field obtained in $CoCr_2O_4$ nanoparticles was not only due to the contribution of interface between collinear and non-collinear spin alignment, but also due to spiral ordering below 30 K. While the exchange interaction and strong interface anisotropy results in an exchange bias field (H_{EB}), the training effect have the contribution from the interface as well as from the core shell interaction depending on the particle size.

Keywords: core-shell nanoparticles, exchange bias, training effect, memory effect