Accepted Manuscript

Effect of Co and O defects on ferromagnetism in Co-doped ZnO: An X-ray absorption spectroscopic investigation

Rishi K. Singhal, Narendra Jakhar, A. Samariya, S.N. Dolia, Sudhish Kumar

PII: S0921-4526(17)30828-1

DOI: 10.1016/j.physb.2017.10.094

Reference: PHYSB 310451

To appear in: Physica B: Physics of Condensed Matter

Received Date: 27 June 2017

Revised Date: 28 August 2017

Accepted Date: 19 October 2017

Please cite this article as: R.K. Singhal, N. Jakhar, A. Samariya, S.N. Dolia, S. Kumar, Effect of Co and O defects on ferromagnetism in Co-doped ZnO: An X-ray absorption spectroscopic investigation, *Physica B: Physics of Condensed Matter* (2017), doi: 10.1016/j.physb.2017.10.094.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

	165N 2027-4828
PHYSICA	D Condensed Matter
	Envi 17.0.00078 4.0.400 4.0.400 4.0.400 4.0.400 4.0.400 4.0.400 4.0.400 4.0.400 4.0.400 4.0.400
matter own if we concident on ScienceDirect	higo Simuma abaminin zami Pacada Jahyapi

Effect of Co and O Defects on Ferromagnetism in Co-doped ZnO: An Xray Absorption Spectroscopic Investigation

Rishi K. Singhal^{*1,1}, Narendra Jakhar¹, A. Samariya², S.N. Dolia¹ and Sudhish Kumar²

¹Department of Physics, University of Rajasthan, Jaipur 302004, India ²S. S. Jain Subodh P. G. College, Jaipur- 302004, India

³Department of Physics, M L Sukhadia University, Udaipur 313 002, India

Abstract

Understanding of origin of ferromagnetism in dilute magnetic oxides (DMO's) has become one of the most challenging research problems in condensed matter physics. Here we are reporting a detailed study of magnetic properties and electronic structure of two 5% Co-doped ZnO samples (the as-prepared sample Zn_{0.95}Co_{0.05}O and the hydrogenated sample Zn_{0.95}Co_{0.05}O:H). The as-prepared sample is found to be paramagnetic while through hydrogenation, we observed inducement of remarkable ferromagnetism in it. The H-mediated magnetic transition is accompanied by electronic structure modifications with no structural deviations. To get in-depth information into electronic structure correlations of the observed ferromagnetism, we have investigated their electronic properties in detail. For this purpose, we have employed the site-selective and element-sensitive X-ray-absorption spectroscopy (XAS) in the vicinity of the Cobalt $L_{2,3}$ edge, the oxygen K edge, and the Zinc L_3 edge using synchrotron radiation. The Co $L_{2,3}$ edge spectra clearly show that Co dopants reside at the Zn sites for both these samples and that they are tetrahedrally coordinated with the ligand O atoms. Very minor changes are observed in the Zn L_3 edge spectra. However, the O 1s edge spectra display dominant additional components in the ferromagnetic hydrogenated sample $Zn_{0.95}Co_{0.05}O:H$, not observed in the asprepared non-magnetic sample Zn_{0.95}Co_{0.05}O. We conclude that the observed spectral features can be attributed to the presence of O vacancies and the hybridization of Co 3d states with O 2p vacancy states. These two factors together are likely to play important role in inducement of ferromagnetic ordering in this Co-doped ZnO system. However, which of these two weighs more in this mechanism, cannot be pinpointed and more studies are required in this regard.

Keywords: Dilute Magnetic Semiconductors; Magnetization; Hybridization; Oxygen Vacancies; X-ray Absorption Spectroscopy; Synchrotron Radiation

¹*Corresponding Author's Email: <u>singhal46@yahoo.co.in</u>

Download English Version:

https://daneshyari.com/en/article/8161498

Download Persian Version:

https://daneshyari.com/article/8161498

Daneshyari.com