Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Surface Defects: Possible Source of Room Temperature Ferromagnetism in Co-Doped ZnO Nanorods[1] ALTAF KARIM, Lawrence Berkeley National Laboratory Berkeley California and COMSATS Institute of Information Technology Islamabad, NADEEM TAHIR, YI-DE CHUANG, KRISTIN PERSSON, TAJAMMUL HUSSAIN, ALEJANDRO CRUZ, Lawrence Berkeley National Laboratory Berkeley California, MUHAMMAD NAEEM, Federal Urdu University of Arts, Science and Technology, Karachi, Pakistan, MUHAMMAD USMAN, Quaid i Azam University Islamabad Pakistan, ZAHID HUSSAIN, RUIMIN QIAO, WANLI YANG, Lawrence Berkeley National Laboratory Berkeley California — Contradicting results about the origin of room temperature ferromagnetism (RTFM) from measurements on different forms of transition metal (TM)-doped ZnO nanostructured materials lead to strong debates on whether RTFM could be an intrinsic property to TM-doped ZnO or not. Through careful synthesis and extensive characterizations, we have excluded the extrinsic contaminations as the cause of RTFM. Our experimental study confirms that defects such as oxygen vacancies lie on surface of nanorods and are likely a source of RTFM. X-ray absorption and emission spectroscopy (XAS and XES) suggest that the doped Co ions, primarily in the divalent state, replace the Zn ions inside the tetrahedral without introducing Co clustering or Zn-related defects. Furthermore, such a trend can be nicely reproduced in GGA+U band structure calculations. Our findings highlight the importance of using the nanocrystalline surfaces to enhance the impurity concentrations and stabilize the ferromagnetism without post-sample annealing in an oxygen-deficient environment.

[1]Office of Science, Office of Basic Energy Sciences, of the U.S. Department of Energy under Contract DE-AC02-05CH11231

Altaf Karim
Lawrence Berkeley National Laboratory Berkeley California and
COMSATS Institute of Information Technology Islamabad

Date submitted: 14 Nov 2013 Electronic form version 1.4