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Room-temperature ferromagnetism of Cu-doped ZnO films probed by soft X-ray magnetic circular dichroism A. RUSYDI, T.S. HERNG, D.-C. QI, J.B. YI, Y.P. FENG, I. SANTOSO, X.Y. GAO, A.T.S. WEE, J. DING, J. BERLIJN, Nanocore, National Univ. of Singapore, W. KU, C. SANCHEZ-HANKE, Brookhaven National Laboratory, K.S. YANG, Y. DAI, School of Physics, Shandong Univ. — In this paper, we report the direct evidence of the room temperature ferromagnetism in O-deficient ZnO:Cu films using soft X-ray magnetic circular dichroism (SXMCD) and X-ray absorption (XAS). SXMCD has revealed two distinct features of Cu atoms associated with (1) magnetically ordered Cu ions present only in the oxygen deficient samples, and (2) magnetically disordered *regular* Cu^{2+} ions present in all the samples. These observations indicate that sufficient amount of both oxygen vacancies (V_O) and Cu impurities are essential to the observed ferromagnetism, and non-negligible portion of Cu impurities are uninvolved in the magnetic order. Based on first-principles calculations, we propose a microscopic "indirect double exchange" model, in which alignment of localized magnetic moment of Cu in the vicinity of the V_O are mediated by the large-sized vacancy orbitals.

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