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Doping Induced Modifications in the Electronic Structure and Magnetism of ZnO films: Valence band and Conduction band Studies

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Highlights:

- PLD grown epitaxial pristine and doped ZnO films
- Observation of room temperature ferromagnetism
- Modifications in the Valence band and Conduction band

Abstract:

The electronic structure of Pulsed Laser Deposited (PLD) ZnO, Zn_{0.95}Fe_{0.05}O (ZFO), Zn_{0.98}Al_{0.02}O (ZAO) and Zn_{0.93}Fe_{0.05}Al_{0.02}O (ZFAO) films were investigated by Photoelectron spectroscopy and X-ray absorption spectroscopy. X-ray diffraction and ϕ -scan measurements show epitaxial c-directional growth of the films. Temperature dependent magnetization and M-H loop measurements show the presence of room temperature magnetic ordering in all the films. Fittings of Fe 2p XPS and Fe L_{3,2}-edge XAS of ZFO and ZFAO films show the presence of Fe, in both, Fe⁺² and Fe⁺³ states in tetrahedral symmetry. Valence band spectra in resonance mode show resonance photon energy at 56 eV showing the presence of Fe²⁺ state (~2eV) near the Fermi level. A significant effect of Fe and Al doping on the spectral shape of O K-edge XAS was observed. Results of the Spectroscopic studies reveal that, ferromagnetism in the films is due to the contribution of oxygen deficiency which increases the number of charge carriers that take part in

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