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Irradiation-Induced Electronic Structure Modifications in ZnO Thin Films Studied by X-Ray Absorption Spectroscopy

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We report the modifications in the electronic structure of ZnO thin films induced by swift heavy ion (SHI) irradiated ZnO thin films by using near edge X-ray absorption fine structure (NEXAFS) spectroscopy at O K-edge was performed at BL10D XAS-KIST beamline at Pohang Accelerator Lab (PAL). ZnO films of 250 nm thickness oriented in [200] plane deposited by RF magnetron sputtering using equal Ar:O₂ atmosphere and air annealed at 500°C for 6 hours for stability were irradiated with 120 MeV Au and 100 MeV O beams separately with different doses ranging from 1×10^{11} to 5×10^{12} ions/cm². High Resolution X-ray diffraction and NEXAFS analysis indicates significant changes in the electronic structure and the SHI effect is different for Ag and O-beams. The NEXAFS measurements provide direct evidence of O 2p and Zn 3d orbital hybridization. The NEXAFS results will be presented in detail.

Keywords: ZnO thin film, Swift heavy ion irradiation, X-ray absorption spectroscopy, RF magnetron sputtering