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X-Ray Absorption Spectroscopic Study of 120 MeV Ag^{9+} Ion-Irradiated N-Doped ZnO Thin Films

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We report the electronic structure modification in the swift heavy ion (SHI) irradiated N-doped ZnO thin films prepared by RF sputtering from ZnO target in different ratio of Ar/N_2 gas mixture using highly pure N_2 gas. The different N-ZnO thin lms were then irradiated with 120 MeV Ag ion beam with different doses ranging from 1×10^{11} to 5×10^{12} ions/cm^2 and characterized by XRD and near edge X-ray absorption ne structure (NEXAFS) at N and O K-edges. The NEXAFS measurements provide direct evidence of O 2p and Zn 3d orbital hybridization and also the bonding of N ions with Zn and O ions. The minimum value of resistivity of 790 Ωcm, a Hall mobility of 22 $cm^2V^-1s^-1$ and the carrier concentration of 3.6×10^{14} cm^{-3} were yielded at 75% N_2. X-ray diffraction (XRD) measurements revealed that N-doped ZnO films had the preferential orientation of (002) plane for all samples, while crystallinity start decreasing at 32.5% N_2. The average crystallite size varies from 5.7 to 8.2 nm for 75% and then decreases to 7.8 nm for 80% $Ar:N_2$ ratio.

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