

Band alignment of ultrathin GIZO/SiO₂/Si heterostructure determined by electron spectroscopy

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Abstrak

ABSTRACT

Amorphous GaInZnO (GIZO) thin films are grown on SiO₂/Si substrate by the RF magnetron sputtering method. By the combination of measured band gaps from reflection energy loss spectroscopy (REELS) spectra and valence band from X-ray photo-electron spectroscopy (XPS) spectra, we have demonstrated the energy band alignment of GIZO thin films. The band gap values are 3.2 eV, 3.2 eV, 3.4 eV and 3.6 eV for the concentration ratios of Ga: In: Zn in GIZO thin films are 1:1:1, 2:2:1, 3:2:1 and 4:2:1, respectively. These are attributed to the larger band gap energy of Ga₂O₃ compared with In₂O₃ and ZnO. The valence band offsets (eV) decrease from 2.18 to 1.68 eV with increasing amount of Ga in GIZO thin films for GIZO1 to GIZO4, respectively. These experimental values of band gap and valence band offset will provide the further understanding in the fundamental properties of GIZO/SiO₂/Si heterostructure, which will be useful in the design, modeling and analysis of the performance devices applications.