

Electronic Supplementary information

Atomic layer deposition of Ti-doped ZnO films with enhanced electron mobility

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Fig. S1 Schematic illustrations of ALD-TZO films. ZnO matrix and 1 cycle of TiO_x were repeatedly deposited, and a doping concentration was varied by changing an ALD cycle ratio of ZnO (m) and TiO_x .

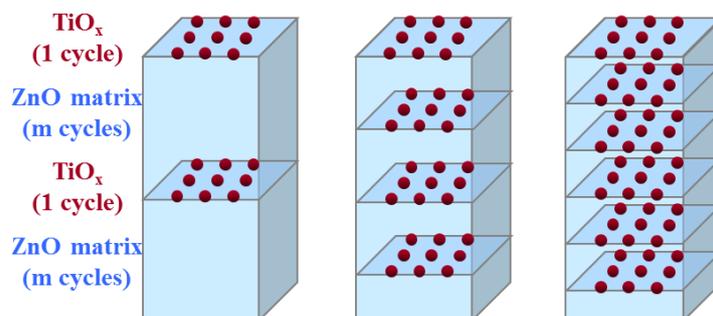


Fig. S2 Auger electron spectroscopy-depth profile of the ALD-TZO film. The ALD cycle ratio of the film was ZnO 99 : TiO_x 1 (0.3 at%).

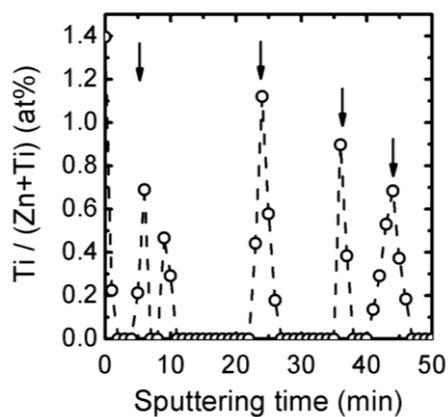


Fig. S3 (a) XRD patterns of TZO films with various cation ratios. Average grain sizes of AZO and TZO films, estimated from (0002) XRD peaks by using the Scherrer equation, as a function of (b) cation ratio and (c) carrier concentration. For clarity, the data points of films having higher carrier concentration than its maximum were excluded in (c).

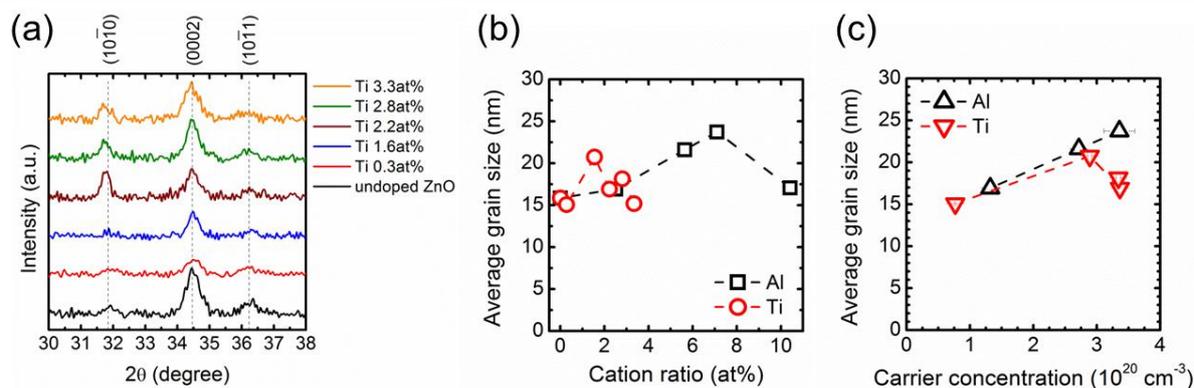


Fig. S4 (a) XRD patterns and (b) average grain size of undoped ZnO, AZO (Al 5.6 at%) and TZO (Ti 1.6 at%) films. The average grain size was estimated from both XRD patterns (Scherrer equation) and plan-view TEM images.

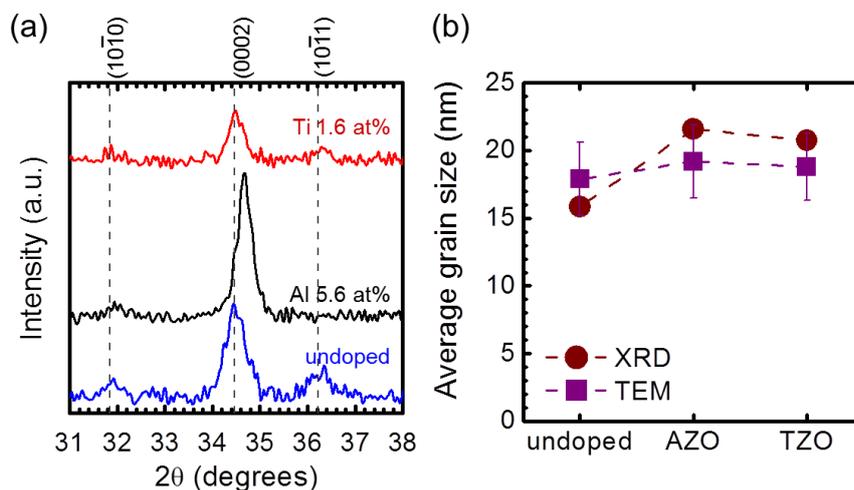


Fig. S5 XPS - Ti $2p_{3/2}$ spectrum obtained from ALD-TZO film (1.6 at% Ti doping). Circles indicate the raw data and solid line indicates the Gaussian fitted one. The sample was Ar-plasma sputtered for 10 min in order to exclude surface contamination and oxidation effects. Adventitious C 1s spectrum (284.8 eV) was referenced for calibration.

