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Supplementary Information

Suppression of redox reaction between IGZO surface and reducing agent TMA using oxidizing agent fluorine treatment

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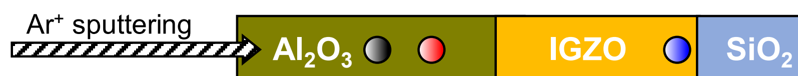

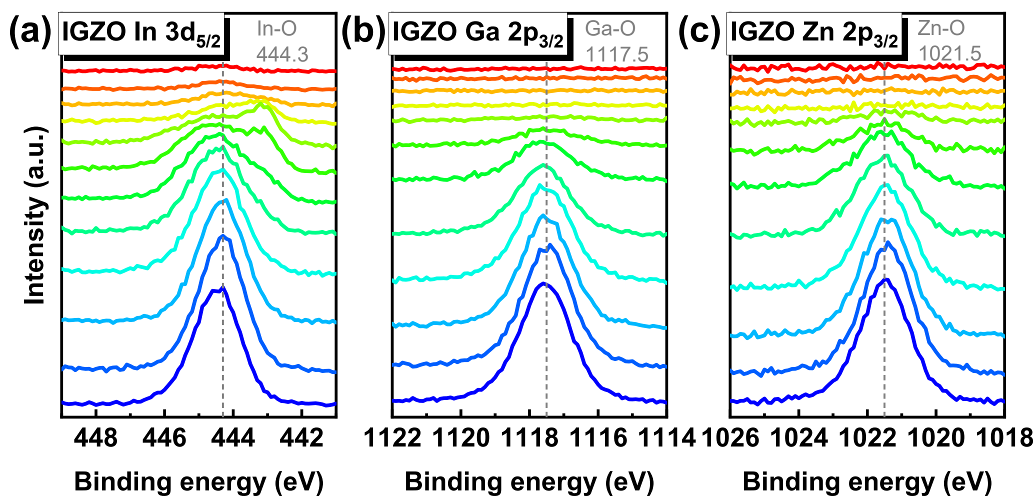

Fig. S 1. The depth–resolved XPS (a) In $3d_{5/2}$, (b) Ga $2p_{3/2}$, and (c) Zn $2p_{3/2}$ core level spectra of standard Al_2O_3/IGZO stack after charge referencing by adventitious carbon (AdC) 1s at 284.8 eV. The gray dashed lines indicate the peak binding energy (BE) values for each metal oxide, that are in good agreement with the NIST database.[1]

[1] NIST X–ray Photoelectron Spectroscopy Database, NIST Standard Reference Database Number 20, https://srdata.nist.gov/xps/, DOI: 10.18434/T4T88K.

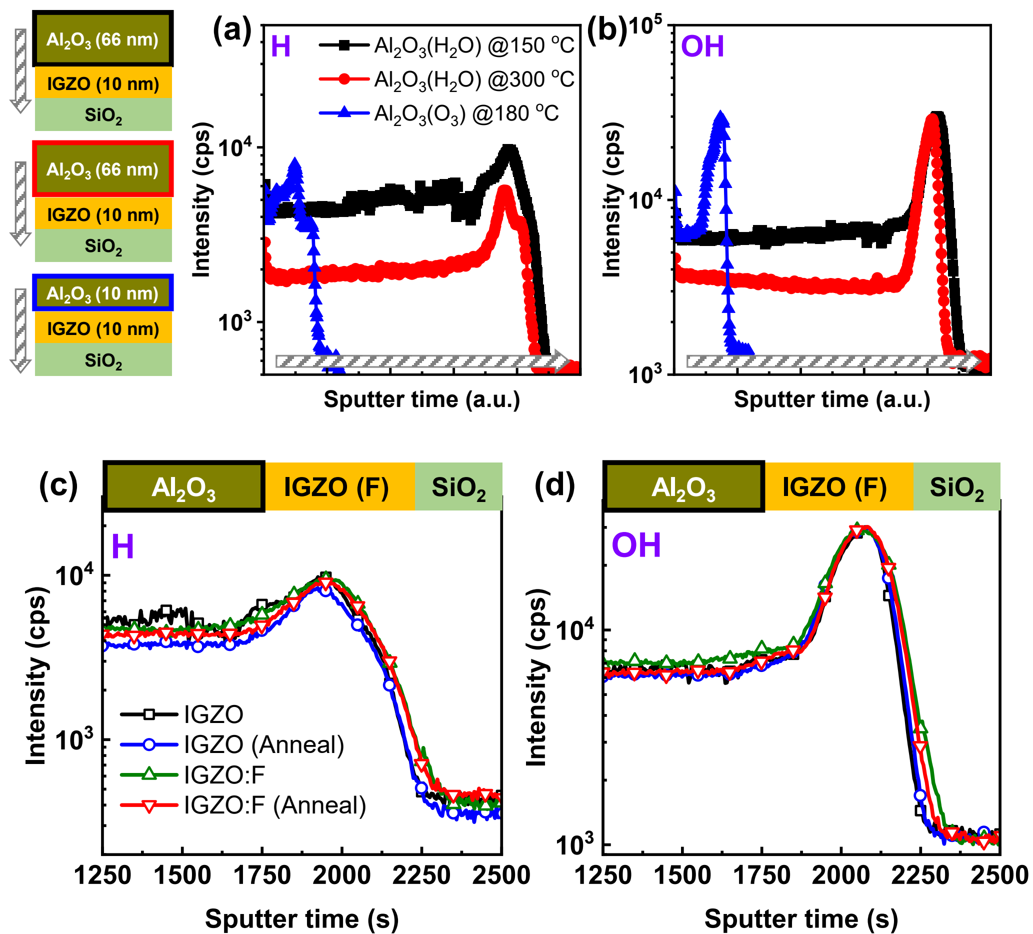

Fig. S 2 TOF–SIMS (a) H and (b) OH profiles of as–prepared Al_2O_3/IGZO stacks with respect to ALD–Al_2O_3 parameters. The gray patterned arrow represents the incident primary beam. The short sputter time of Al_2O_3 at a substrate temperature of 180 °C using O_3 gas as an oxidant (blue) is due to the thickness of 10 nm–thick Al_2O_3. Enlarged TOF–SIMS (c) H and (d) OH profiles near the Al_2O_3/IGZO (F) interfaces, where the Al_2O_3 was deposited at a substrate temperature of 150 °C using H_2O as an oxidant because of the highest H related concentrations. The annealing was conducted by a hot plate at 180 °C for 1 hr, which was the same process condition used for TFT fabrication.

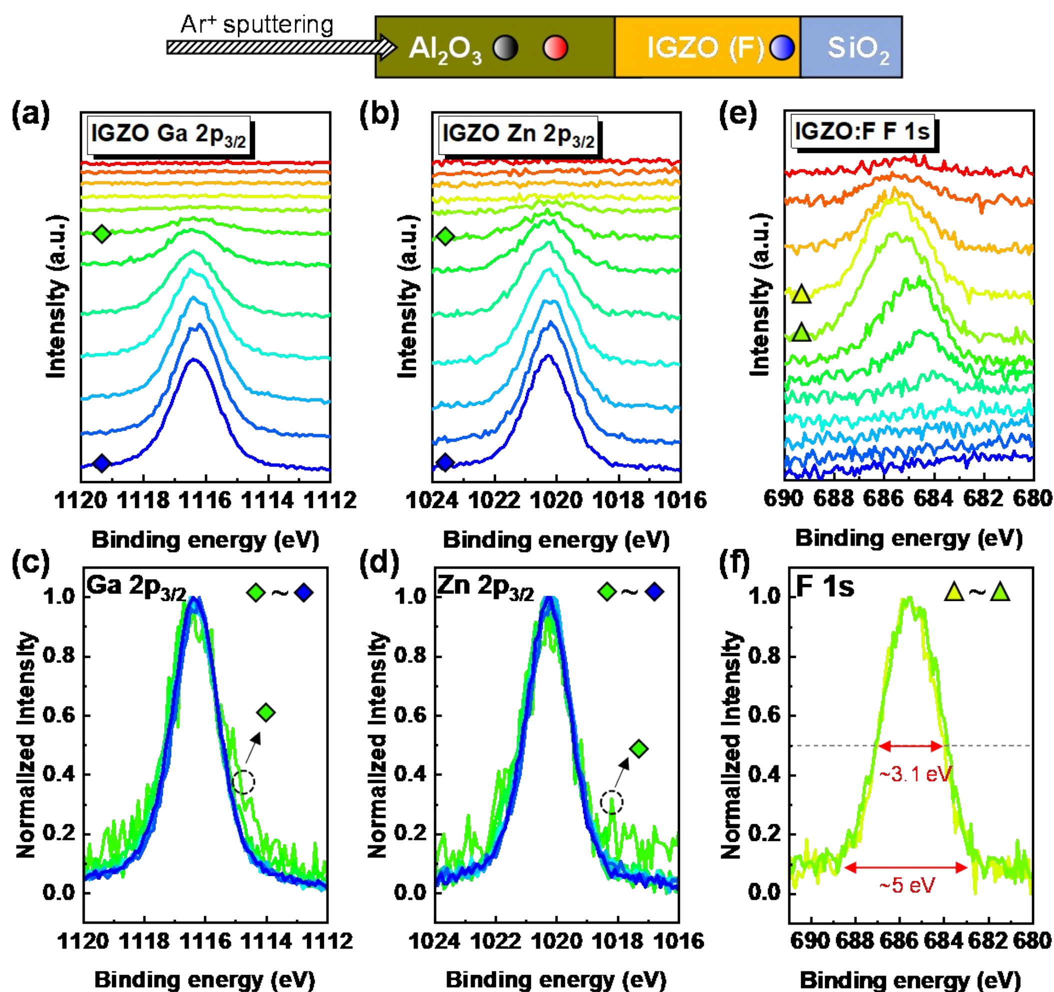

Fig. S 3 The depth−resolved XPS (a) Ga $2p_{3/2}$ and (b) Zn $2p_{3/2}$ core level raw spectra of standard Al_2O_3/IGZO stack. The normalized (c) Ga $2p_{3/2}$ and (d) Zn $2p_{3/2}$ core level raw spectra of standard Al_2O_3/IGZO stack. (e) The depth−resolved XPS F 1s core level raw spectra of Al_2O_3/IGZO:F stack. (f) The normalized F 1s core level raw spectra of Al_2O_3/IGZO:F stack.

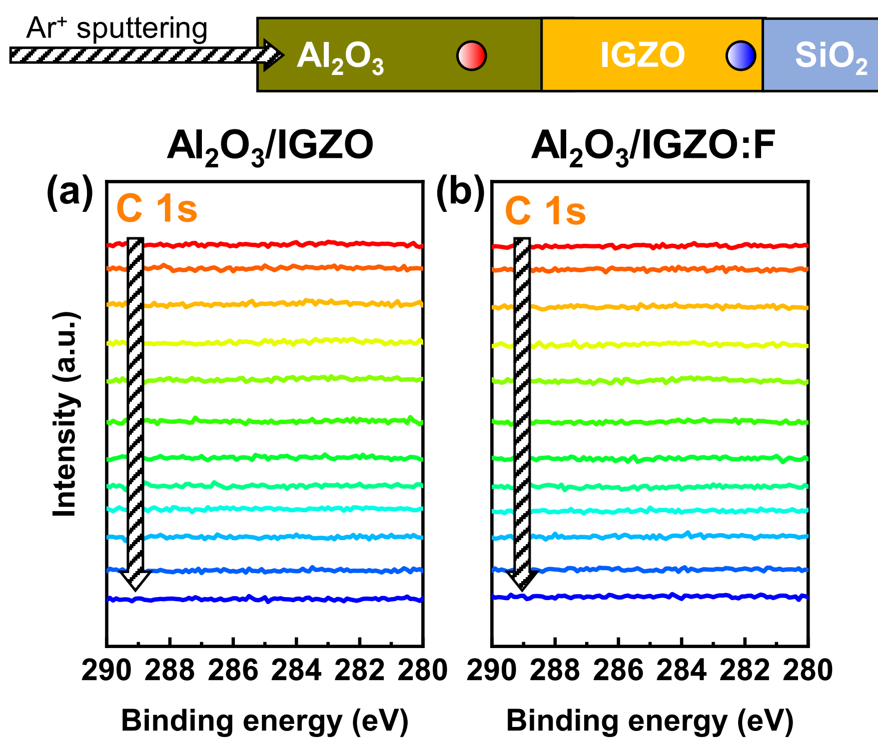

Fig. S 4 The depth–resolved XPS C 1s core level raw spectra of (a) Al_2O_3/IGZO and (b) Al_2O_3/IGZO:F stacks.