Supplementary information

Negative threshold voltage shift in an a-IGZO thin film transistor under X-ray irradiation

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Figures S1 (a) and (b) show the XPS spectra of the O1s chemical state before and after X-ray irradiation of an a-IGZO film, respectively. These spectra were deconvoluted through a Gaussian fit. The binding energy peaks reveal fully oxidized oxygen (M-O) at 529.7 ± 0.1 eV, an oxygen vacancy (V_O) at 530.7 ± 0.1 eV, and oxygen in the hydroxide state (M-OH) at 531.7 ± 0.1 eV. The peaks related to oxygen vacancy did not change significantly before and after X-ray irradiation, the percentage oxygen vacancies being 25.8% and 26.1% before and after X-ray irradiation, respectively. These results suggest that the cause of increased electron concentration during X-ray irradiation of a-IGZO film is not strongly related to the formation of oxygen vacancies. We estimated these results are attributed to the high permeability of X-ray irradiation with high photon energy.

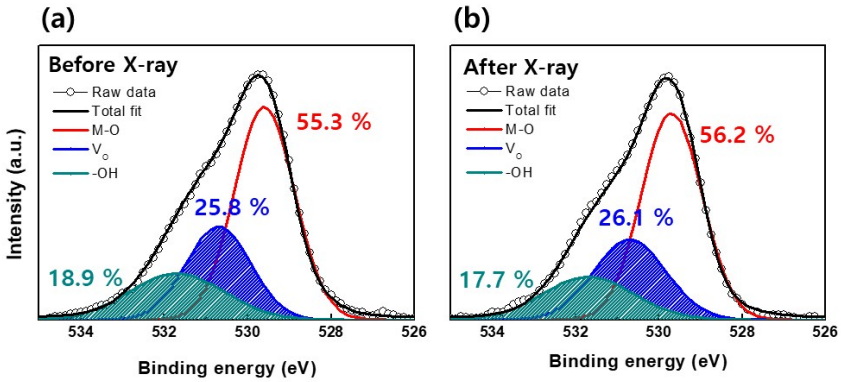

Figure S1. X-ray photoelectron spectroscopy (XPS) spectra of the O1s chemical state for the In-Ga-Zn-O (a-IGZO) film (a) before and (b) after X-ray irradiation. The binding energy states are related to fully oxidized oxygen (529.7 ± 0.1 eV), oxygen vacancy (530.7 ± 0.1 eV), and hydroxide (531.7 ± 0.1 eV), with the three binding states deconvoluted by Gaussian fits.