Electronic Supplementary Information

Besides the first, second ITZO and Zn doped In$_2$O$_3$ devices, other ITZO devices are listed in below. These devices were fabricated and electrical measurement were performed in same condition or ambient with previous ones. SEM, EDX and current-voltage characteristics are listed for all these devices.

- Third ITZO Device

Fig. S1. SEM and EDX analysis results of third ITZO device
Fig. S2 I-V characteristics in dark and under UV light of third ITZO device.

- Fourth ITZO Device

Fig. S3 SEM and EDX analysis for the fourth ITZO device.
Fig. S4 Current-voltage characteristic of the fourth ITZO device in dark and under UV light.

- Fifth ITZO Device

Fig. S5 SEM and EDX analysis results of fifth ITZO device.
Fig. S6 Current-voltage characteristic of fifth ITZO device in dark and under UV light.

- **Sixth ITZO Device**

Fig. S7 SEM and EDX analysis results of sixth ITZO device.
Fig. S8 Current-voltage characteristics of sixth ITZO device in dark and under UV light.

- Seventh ITZO Device

Fig. S9 SEM and EDX analysis results of seventh ITZO device.
Fig. S10 Current-voltage characteristics of seventh ITZO device in dark and under UV light.

Fig. S11 Current-voltage characteristics of third, fourth, fifth, sixth and seventh ITZO device in dark.
Fig. S12. The I-V measurement result of the ITZO device with nanowire and without nanowire between Si electrodes. The measurement result confirmed that no conductivity after broke the nanowires.