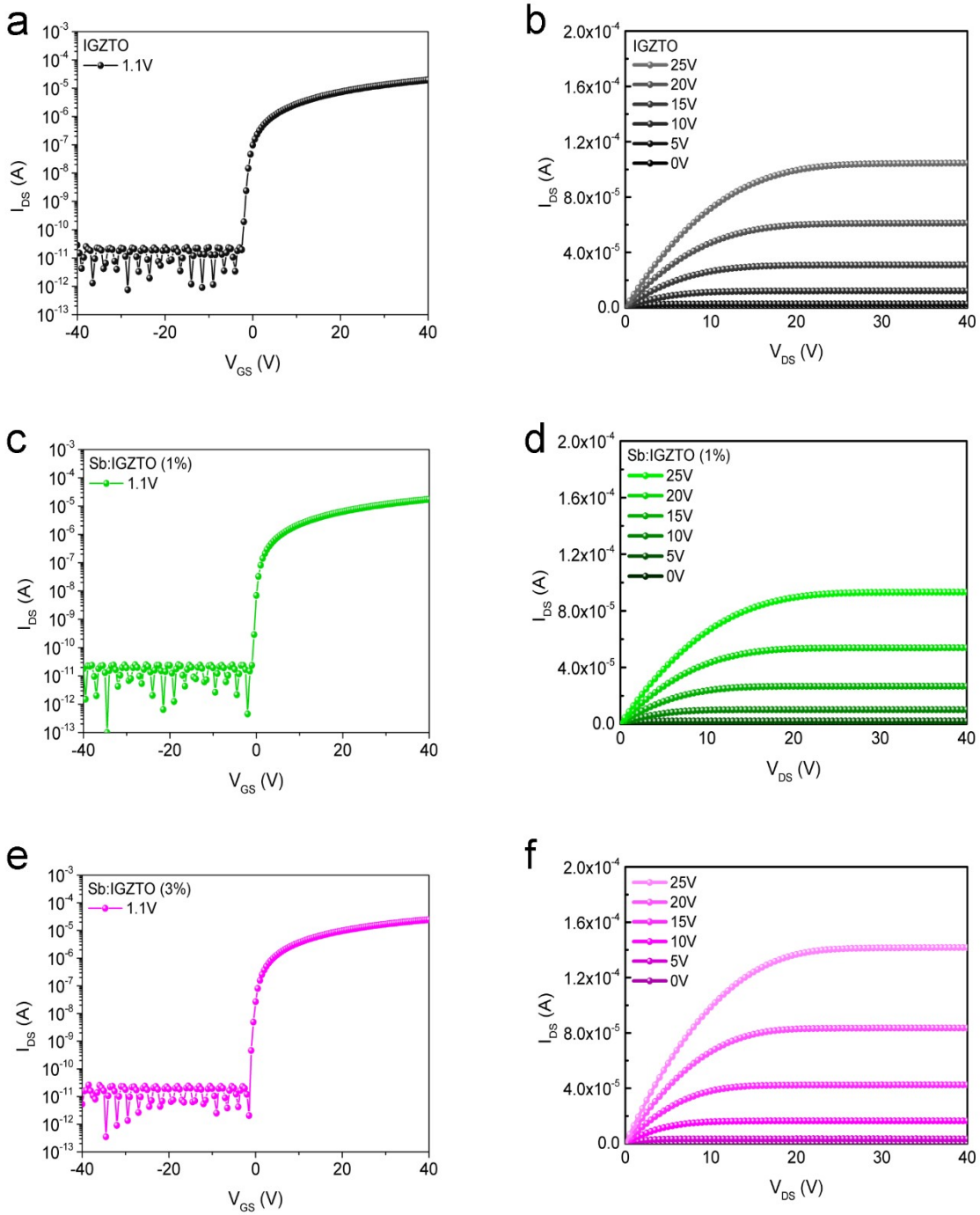
Supporting Information

Solution-processed antimony-doped IGZTO thin-film transistors exhibiting superior operational stability in extreme environmental conditions

*Eun Jin Park[1,2], Bu Kyeong Hwang[1], Bo Ram Lee[1], In Pyo Park[1], Hyun sung Jung[1], Min-Kyu Son[1], Hyeon Jin Jung[1***], Pung Keun Song[2**] and Soo Won Heo[1*]*

Supporting information



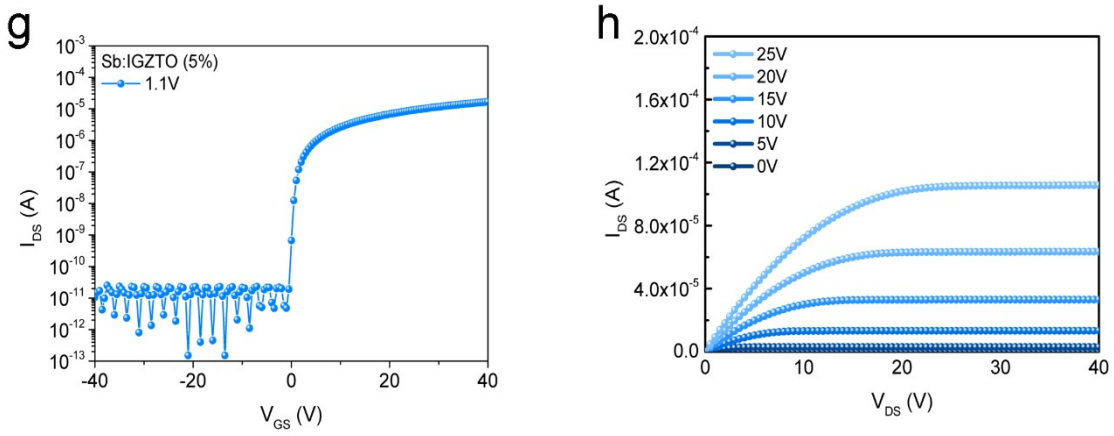


Figure S1. Transfer(I_{DS}−V_{GS}) and Output (I_{DS}−V_{DS}) characteristics of (a-b) IGZTO, (c-d) Sb:IGZTO(1%), (e-f) Sb:IGZTO(3%), (g-h) Sb:IGZTO(5%) TFTs.

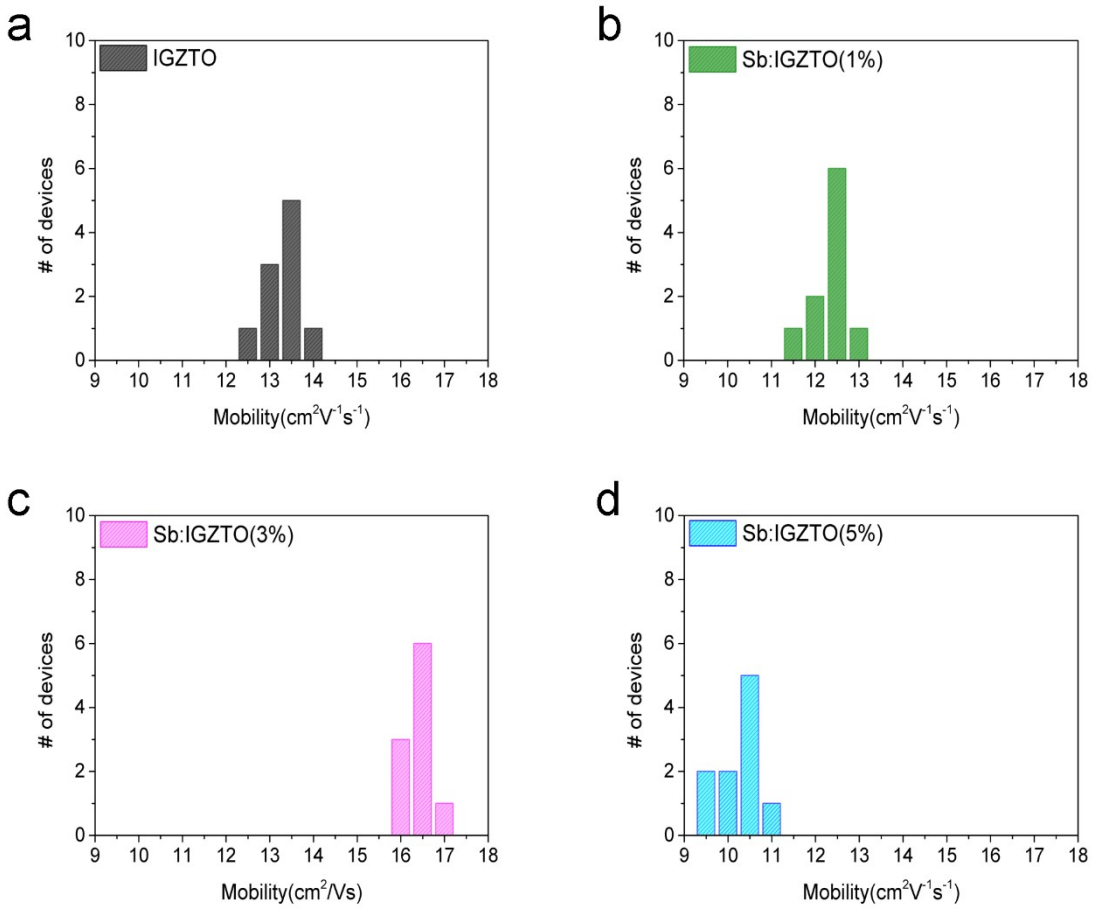


Figure S2. Mobility distributions of the (a) IGZTO TFTs, (b) Sb:IGZTO(1%), (c) Sb:IGZTO(3%) and (d) Sb:IGZTO(5%) TFTs , respectively.

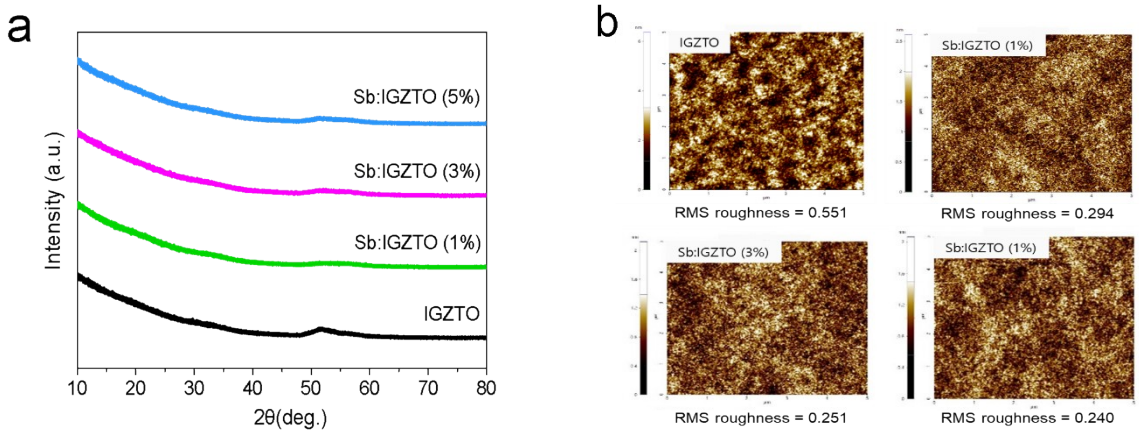


Figure S3. (a) GIXRD patterns and (b) AFM images of IGZTO films with various Sb doping levels.

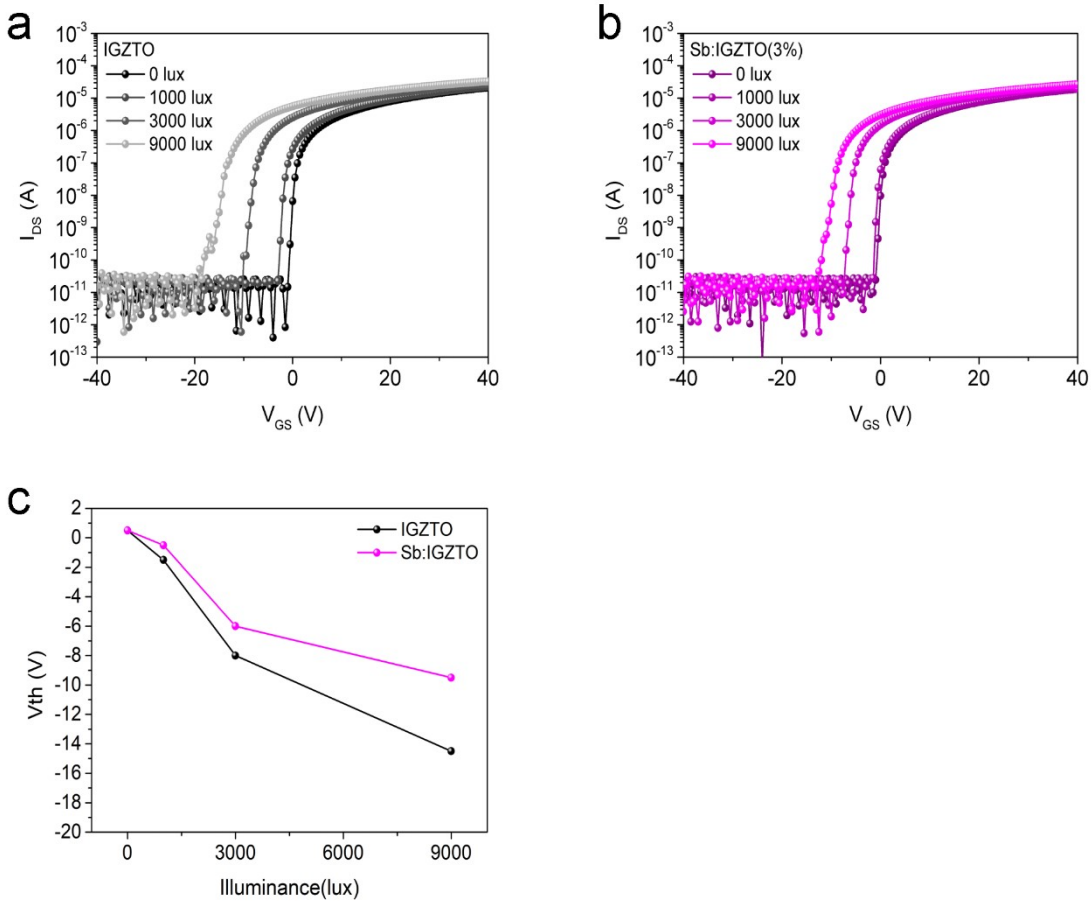


Figure S4. (a) Photo-response of the IGZTO TFTs and Sb:IGZTO(3%) TFTs. (b) threshold voltage shift of the IGZTO TFTs and Sb:IGZTO(3%) TFTs under photo-response , respectively.

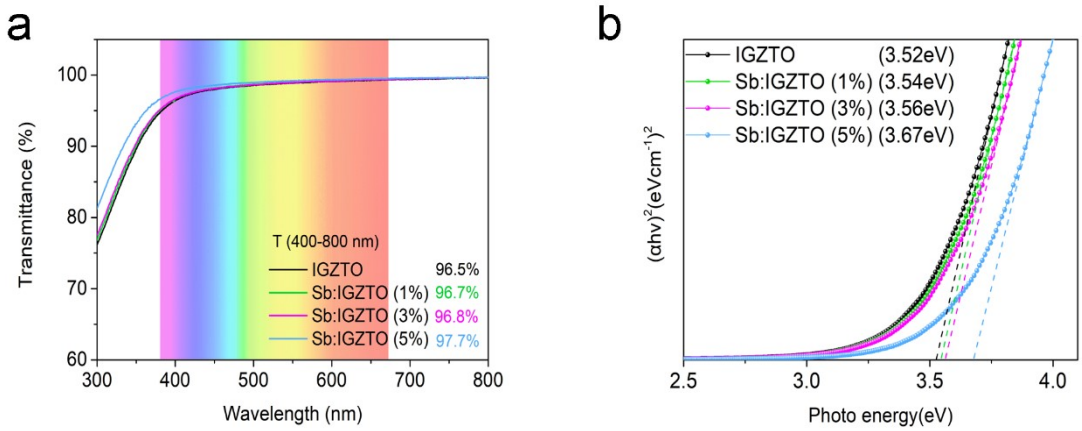


Figure S5. (a) Transmittance spectra and (b) Tauc plot optical bandgaps calculated from UV–vis absorbance spectra for IGZTO films with various Sb concentrations.

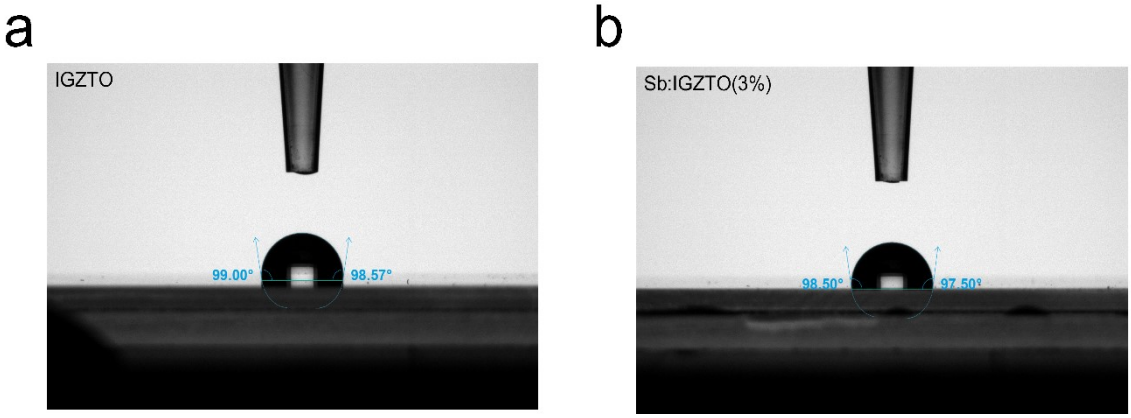
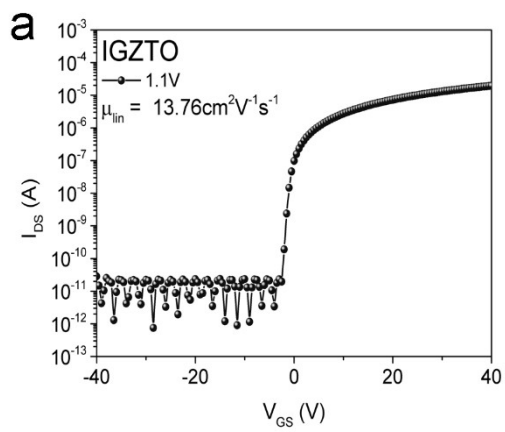
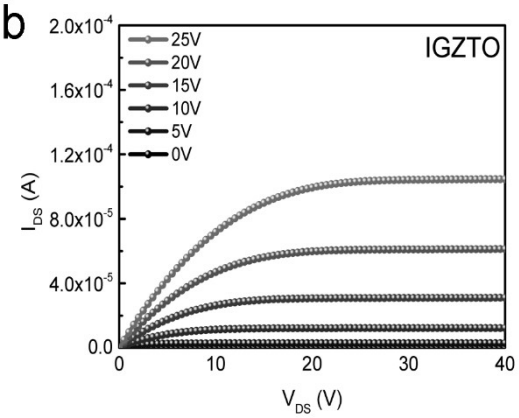
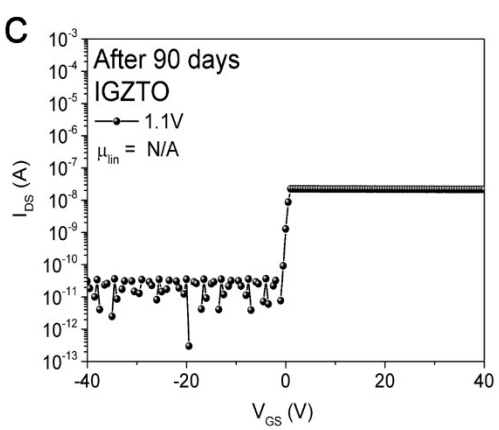
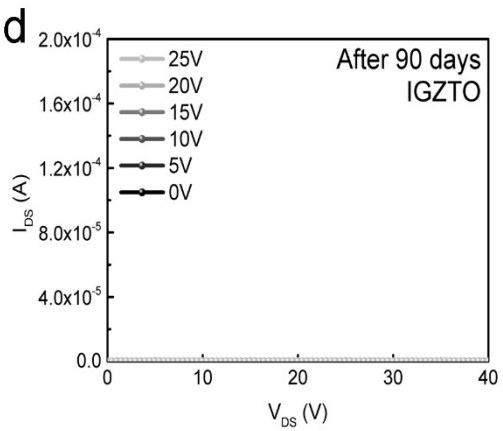


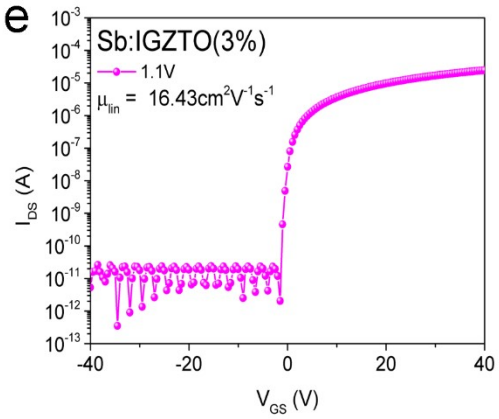
Figure S6. Water contact angle images of IGZTO and Sb:IGZTO (3%) thin films

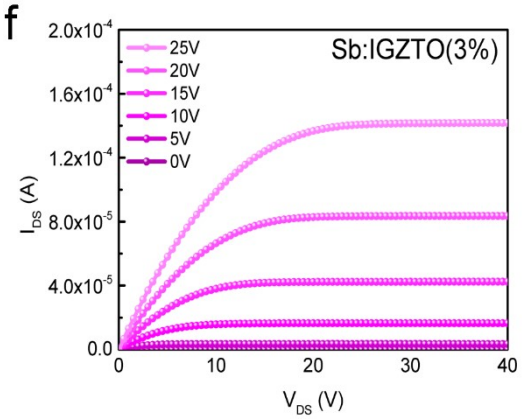

a
IGZTO
1.1V
μ_{lin} = 13.76cm^{2}V^{-1}s^{-1}
I_{DS} (A)
V_{GS} (V)


b
IGZTO
25V
20V
15V
10V
5V
0V
I_{DS} (A)
V_{DS} (V)


c
After 90 days
IGZTO
1.1V
μ_{lin} = N/A
I_{DS} (A)
V_{GS} (V)


d
After 90 days
IGZTO
25V
20V
15V
10V
5V
0V
I_{DS} (A)
V_{DS} (V)


e
Sb:IGZTO(3%)
1.1V
μ_{lin} = 16.43cm^{2}V^{-1}s^{-1}
I_{DS} (A)
V_{GS} (V)


f
Sb:IGZTO(3%)
25V
20V
15V
10V
5V
0V
I_{DS} (A)
V_{DS} (V)

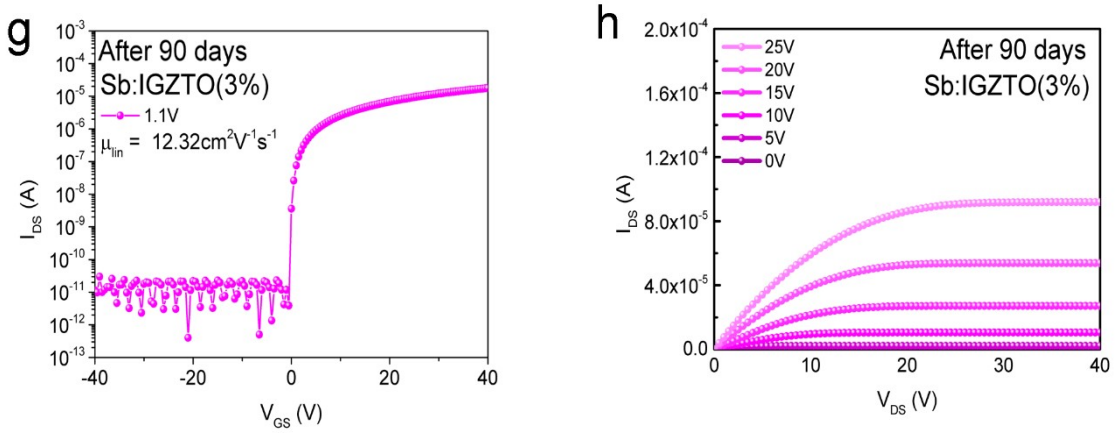


Figure S7. Transfer ($I_{DS}-V_{GS}$) and Output ($I_{DS}-V_{DS}$) characteristics of (a-d) the IGZTO TFTs and (e-h) Sb:IGZTO(3%) TFTs at initial and after 90 days (RH 85%, 85°C temperature), respectively.

Process	Channel materials	Initial Mobility [$cm^2V^{-1}s^{-1}$]	Long term stability period [days]	Storage environment	Retention rate relative to the initial mobility. [%]	Ref
RF magnetron sputtering	Hydrogenated IGZO(HPHA)	9.4	145	Air ambient	81.91	[43]
Solution	a-IGZO	4.20±0.15	6	Under 5% RH at RT.	84.76	[44]
				Over 90% RH at RT	54.29	
Solution	a-WTZO	0.5	31	Air ambient	No mobility data available, increased off-current.	[45]
Solution	a-Sb:IGZTO	16.43	90	85% RH at 85°C temperature	74.98	This work

Table S1. Comparison of Long-Term Stability Parameters for Thin-Film Transistors Fabricated with Various Storage Environments and Channel Materials.