Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Chemical durability engineering of solution-processed oxide thin films and its application for chemically-robust patterned oxide thin-film transistors

Sung Woon Cho,‡ Da Eun Kim,‡ Won Jun Kang, Bora Kim, Dea Ho Yoon, Kyung Su Kim, Hyung Koun Cho,* Yong-Hoon Kim, and Yunseok Kim

School of Advanced Materials Science and Engineering, Sungkyunkwan University, 2066 Seobu-ro, Jangan-gu, Suwon, Gyeonggi-do 16419, Republic of Korea

Corresponding Author

*Tel.: +82 31 290 7364. Fax: +82 31 290 7410. E-mail: chohk@skku.edu.

‡S.W.C. and D.E.K. contributed equally to this work.

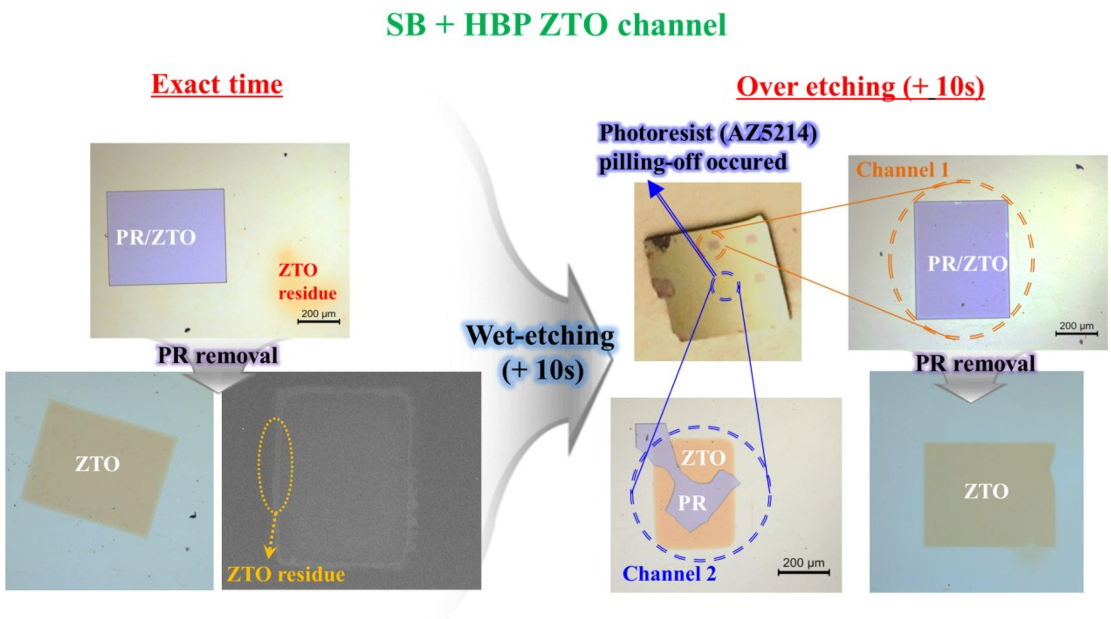

Figure S1. Chemically robust 25 nm-SB + HB ZTO channels patterned (SB + HBP ZTO channel) using a low-pH HCl (pH ≈ 0) wet etchant. (a) Exact- and (b) over-etching.

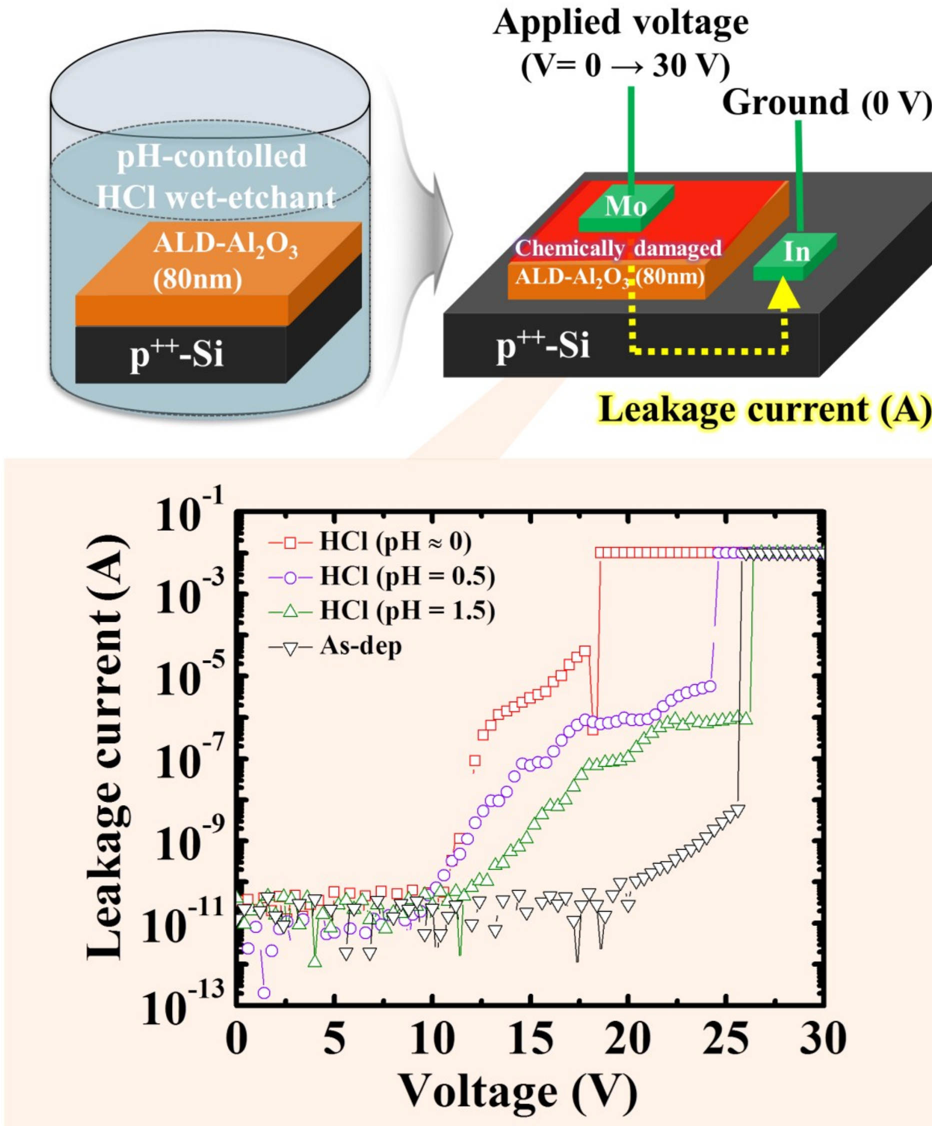

Figure S2. Leakage current-voltage curves for ALD-Al_2O_3 films (80 nm) on Si substrate immersed in pH-controlled HCl wet etchants for 60 s.

XPS spectra for O 1*s*

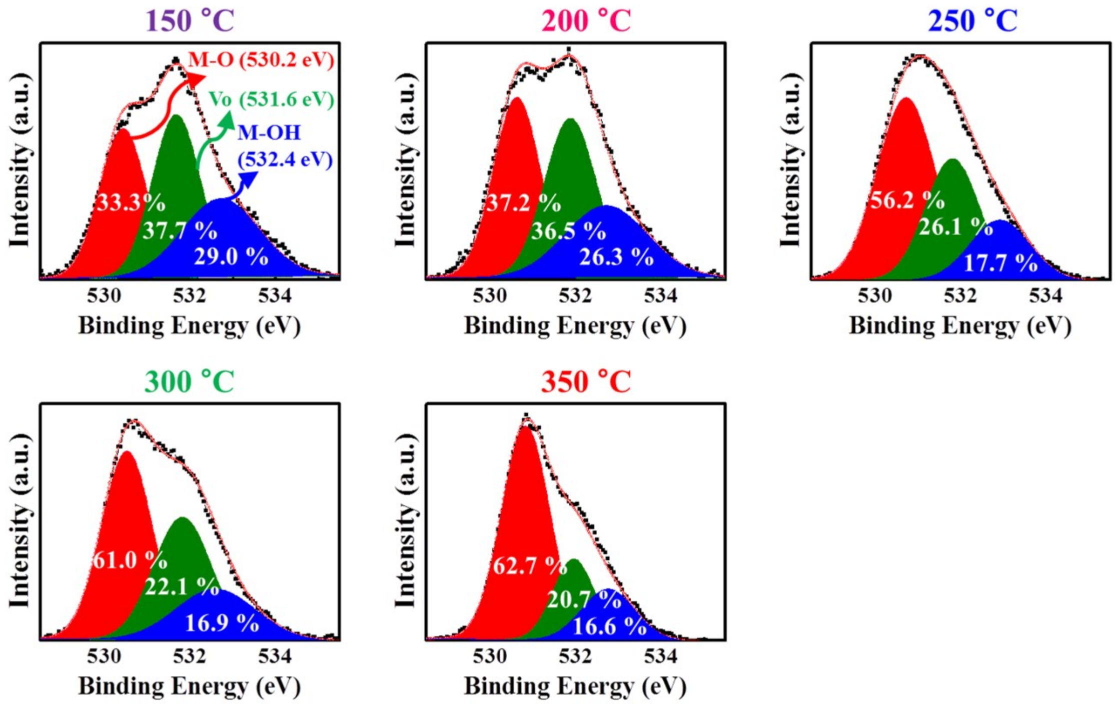

Figure S3. XPS O 1*s* peaks of sol-gel processed SB ZTO films annealed at various SB annealing temperatures (150–350 °C). (a) 150 °C, (b) 200 °C, (c) 250 °C, (d) 300 °C, and (e) 350 °C. Individual O 1*s* peaks were deconvoluted using the Lorentzian-Gaussian distribution into three sub-peaks; metal-oxygen (M-O, 530.2 ± 0.05 eV, red curve), oxygen deficiency (V_O, 531.6 ± 0.02 eV, green curve), and metal-hydroxide bonds (M-OH, 532.4 ± 0.01 eV, blue curve).

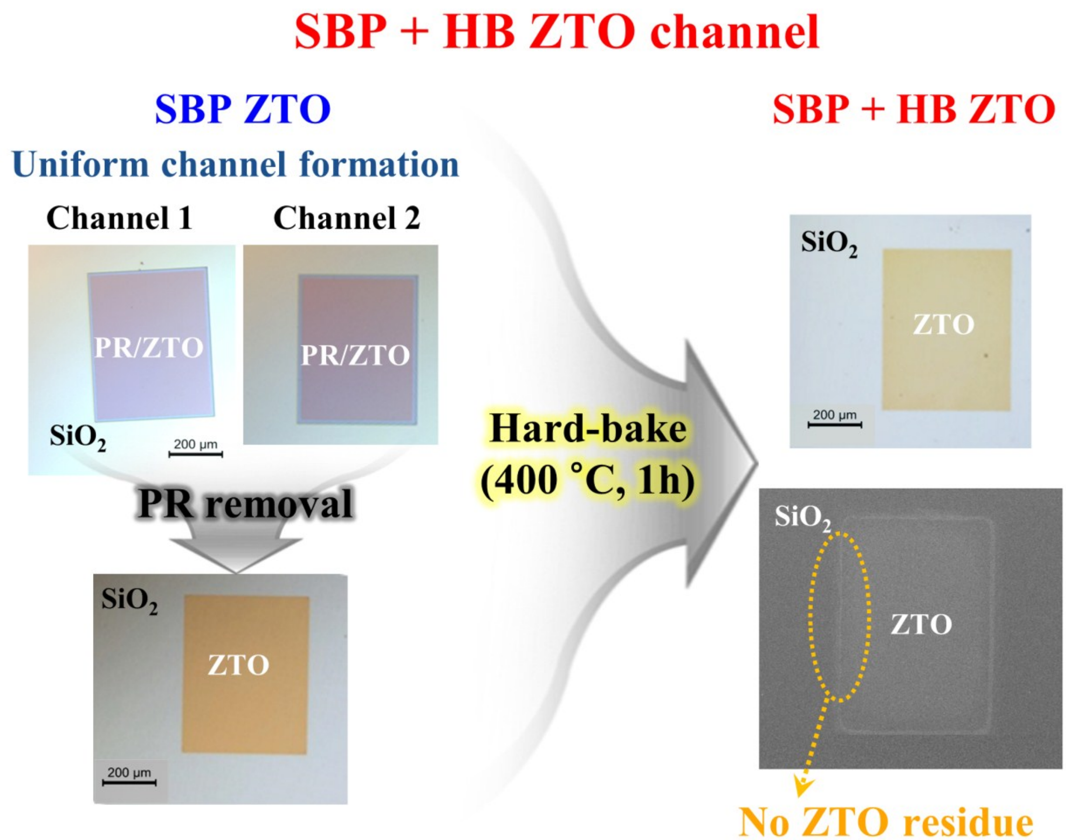

Figure S4. (a) Chemically weak SB ZTO channel patterned (SBP ZTO) using a mild-pH HCl (pH = 1.5) wet etchant. (b) Chemically robust SBP ZTO channel hard-baked (SBP + HB ZTO) at 400 °C.

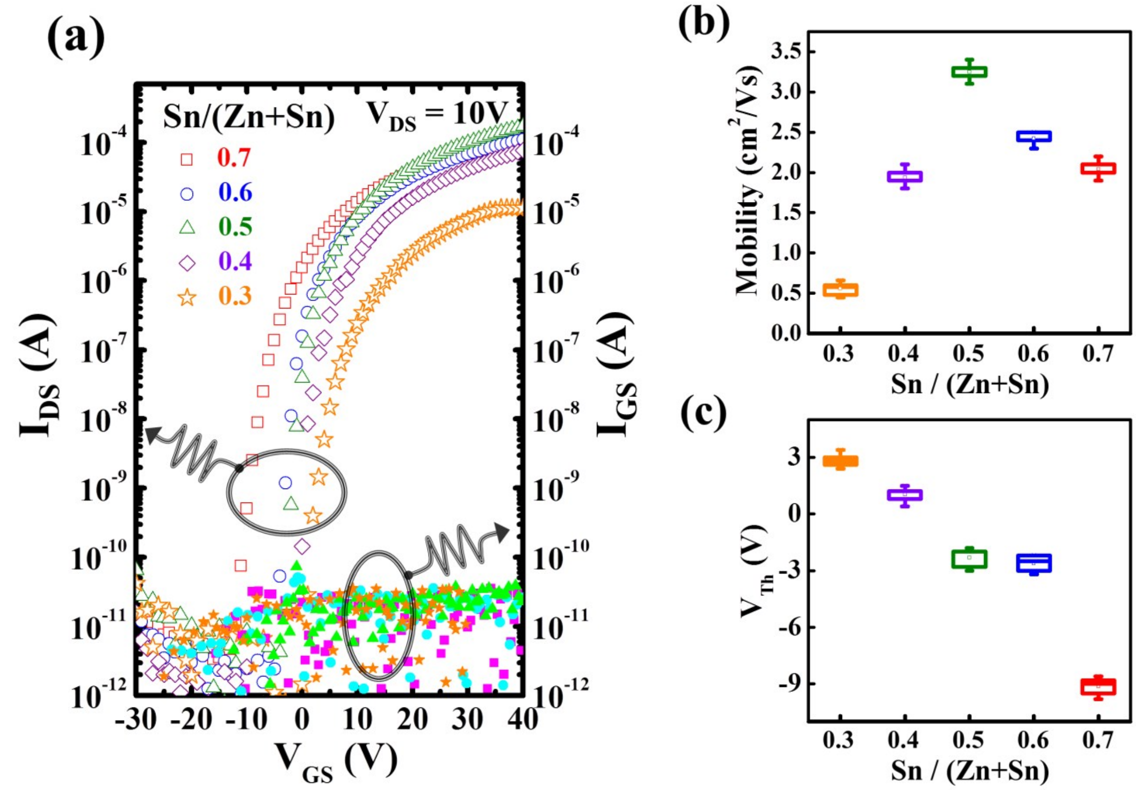

Figure S5. Electrical device performance and uniformity of well-patterned solution-processed SBP + HB ZTO TFTs with various compositional ratios of Zn and Sn [0.3 ≤ Sn/(Zn + Sn) ≤ 0.7]. (a) Transfer characteristics at V_{DS} = 10 V, (b) field-effect mobility, and (c) threshold voltage.

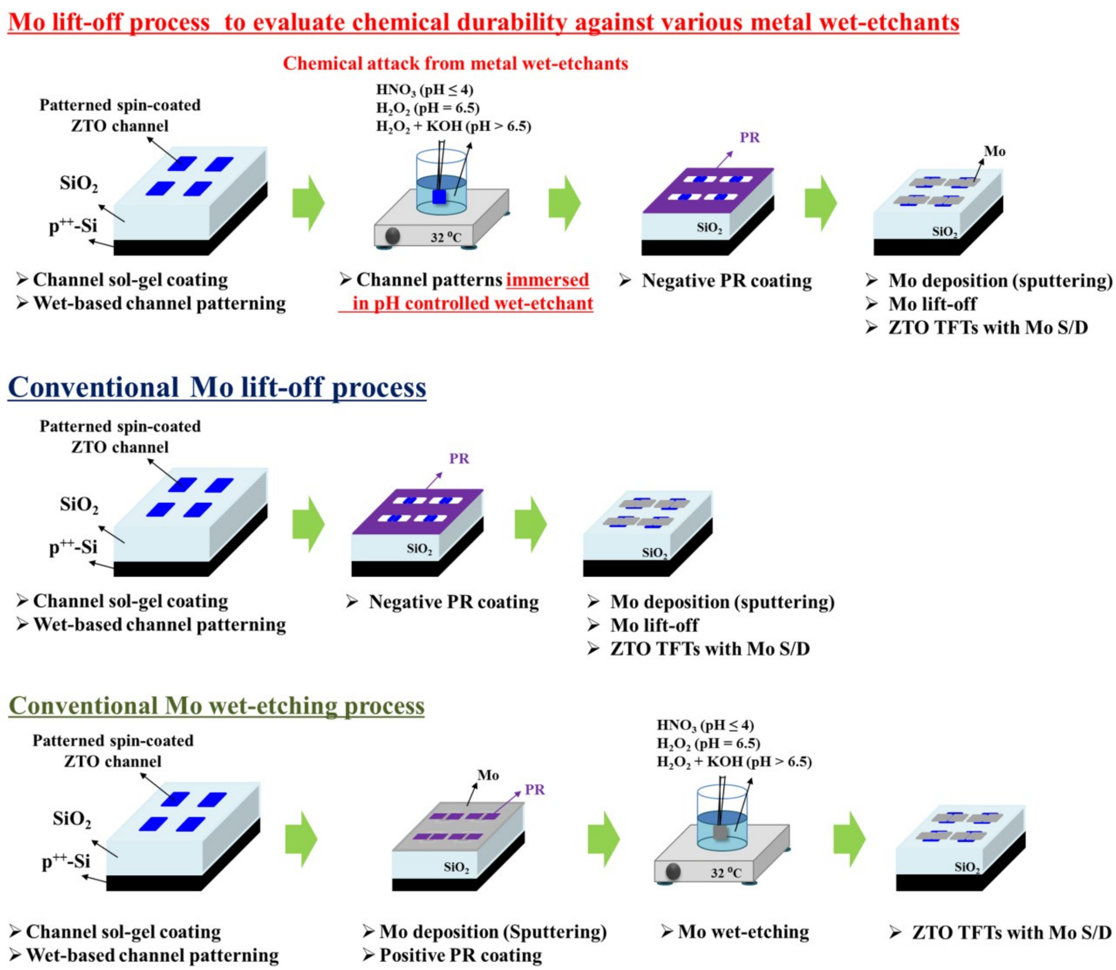

Figure S6. Lift-off process designed to evaluate chemical durability of ZTO channel in various wet-etchants used for Mo wet-etching process. Conventional lift-off and wet-etch processes to define Mo S/D electrodes for oxide TFTs with bottom-gate and top-contact structure.