Supporting Information

Composition-Dependent Structural and Electrical Properties of P-type SnO_x Thin Films Prepared by Reactive DC Magnetron Sputtering: Effects of Oxygen Pressure and Heat Treatment

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Table S1. Chemical compositions of Sn (Sn^0, Sn^{2+}, and Sn^{4+}) and O content in SnO_x films fabricated under various P_O conditions, before and after heat treatment at 210 °C for 1 h.

P_O (%)	As deposited (at.%)				After heat treatment (at.%)			
	Sn^0	Sn^{2+}	Sn^{4+}	O/Sn+O	Sn^0	Sn^{2+}	Sn^{4+}	O/Sn+O
4	52.2	45.0	2.8	24.3	23.2	74.0	2.7	36.3
6	43.9	52.9	3.2	28.2	21.8	74.4	3.7	36.1
8	40.4	56.0	3.6	29.3	21.1	74.4	4.4	36.3
10	23.5	71.5	5.0	35.4	17.7	75.8	6.6	37.8
12	3.3	84.7	12.1	43.5	2.8	85.2	12.1	44.0

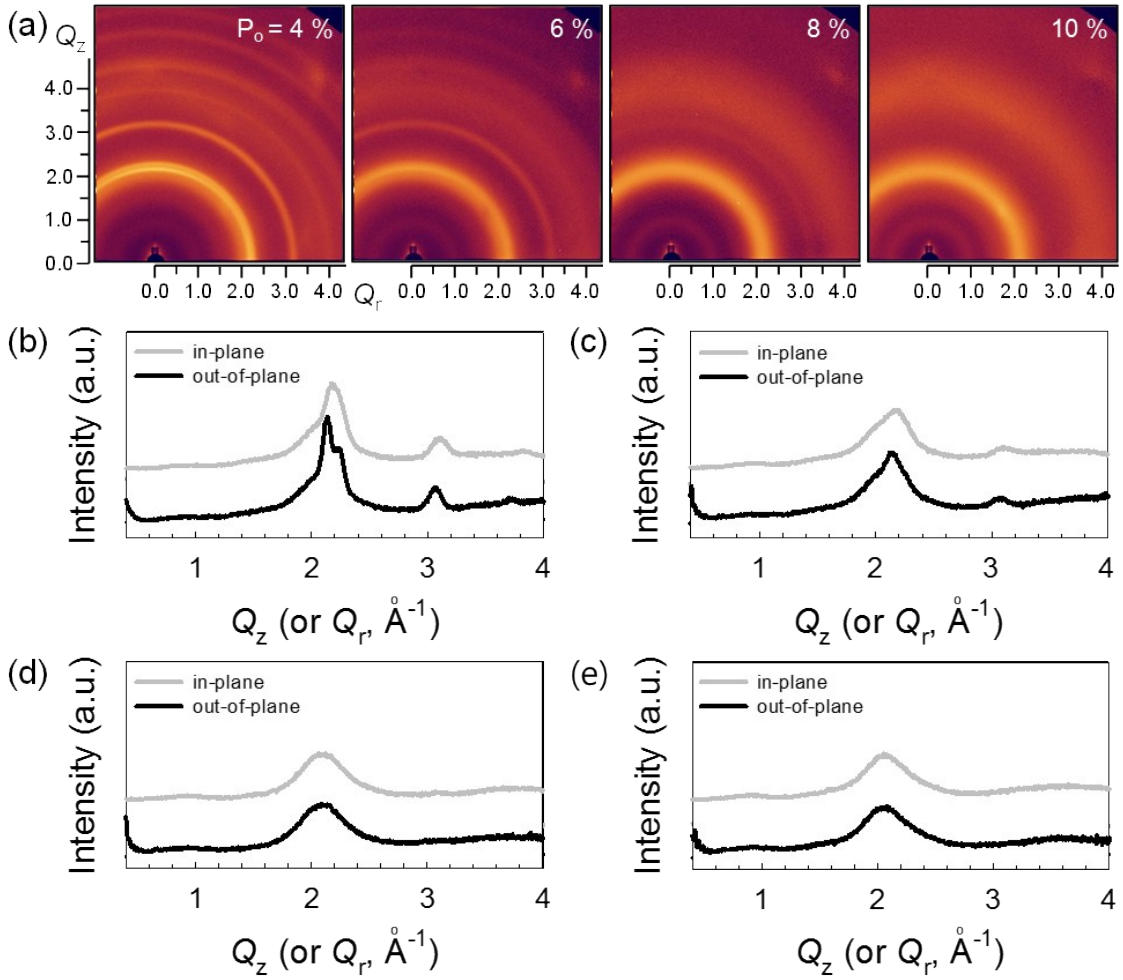

Figure S1. (a) 2D GIXD patterns of as-deposited SnO_x films fabricated at P_O = 4, 6, 8, and 10 %. (b–e) 1D in-plane and out-of-plane X-ray profiles extracted from the patterns shown in (a): (b) 4, (c) 6, (d) 8, and (e) 10 % P_O samples.

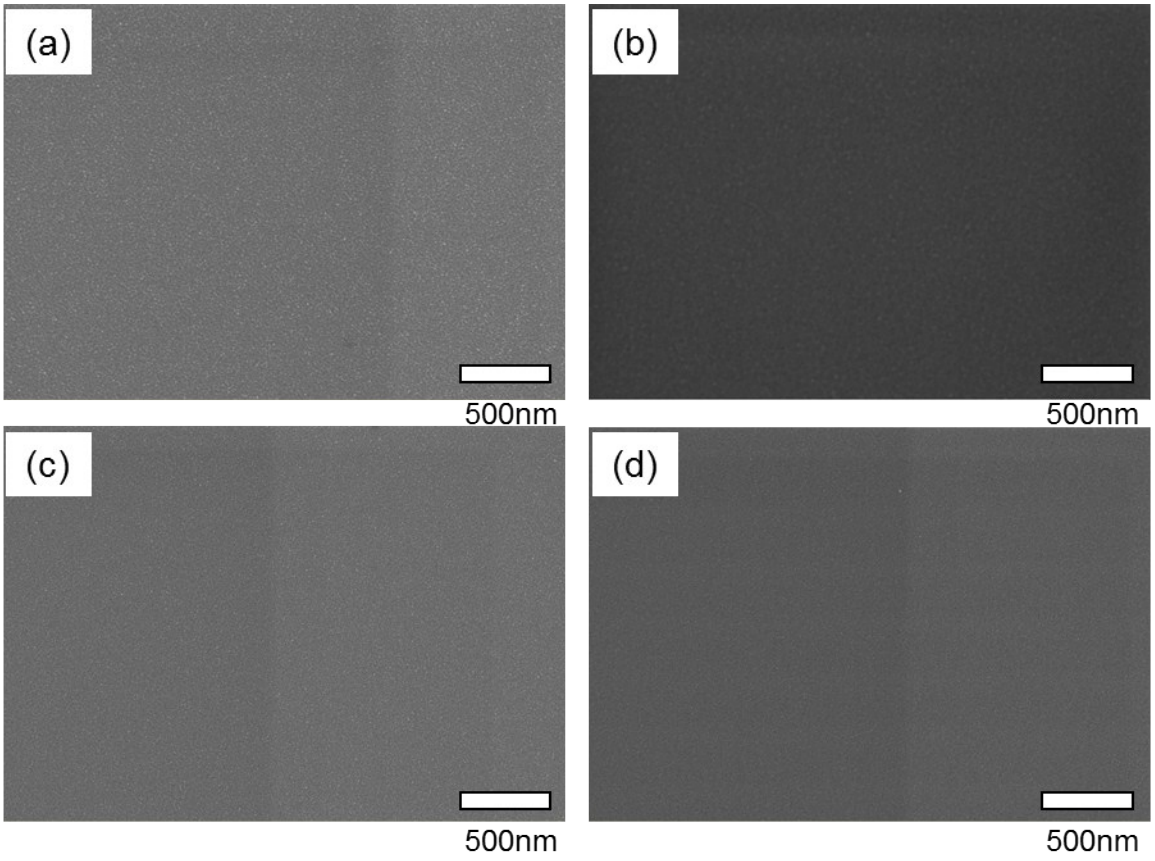

Figure S2. SEM images of as-deposited SnO_x thin films (15-nm-thick) fabricated under various P_O: (a) 4, (b) 6, (c) 8, and (d) 10 %.

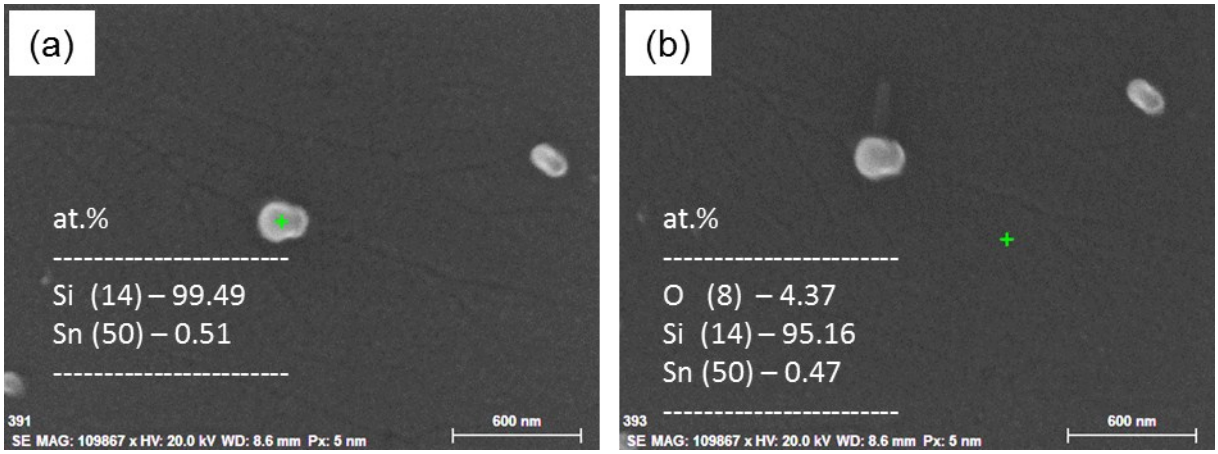

Figure S3. Energy dispersive X-ray spectroscopy (EDS) analysis of atomic composition in the SnO_x thin films (15-nm-thick) deposited on a Si substrate under P_O of 8 % and heat-treated at 210 °C for 1 h: (a) at the irregular protrusion and (b) outside of the irregular protrusion.

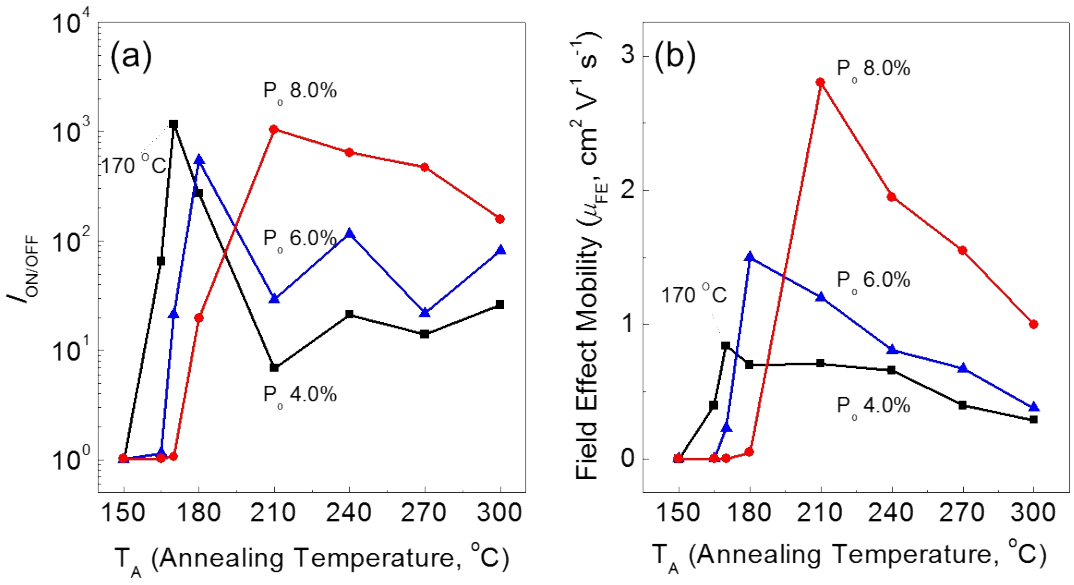

Figure S4. TFT performance metrics extracted from transfer characteristics of bottom gate TFTs prepared using SnO_x thin films (15-nm-thick) deposited under P_O of 4–8 % and heat-treated at T_A of 150–300 °C: (a) $I_{ON/OFF}$ ratio and (b) field effect mobility (μ_{FE}).

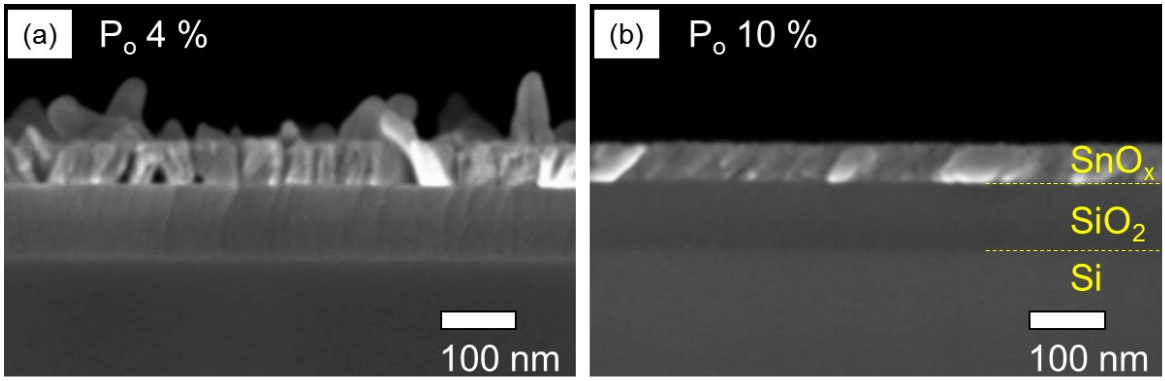

Figure S5. SEM micrographs of 45-nm-thick SnO_x films fabricated under P_O of (a) 4% and (b) 8%, and both subsequently annealed at 210 °C for 1 h.